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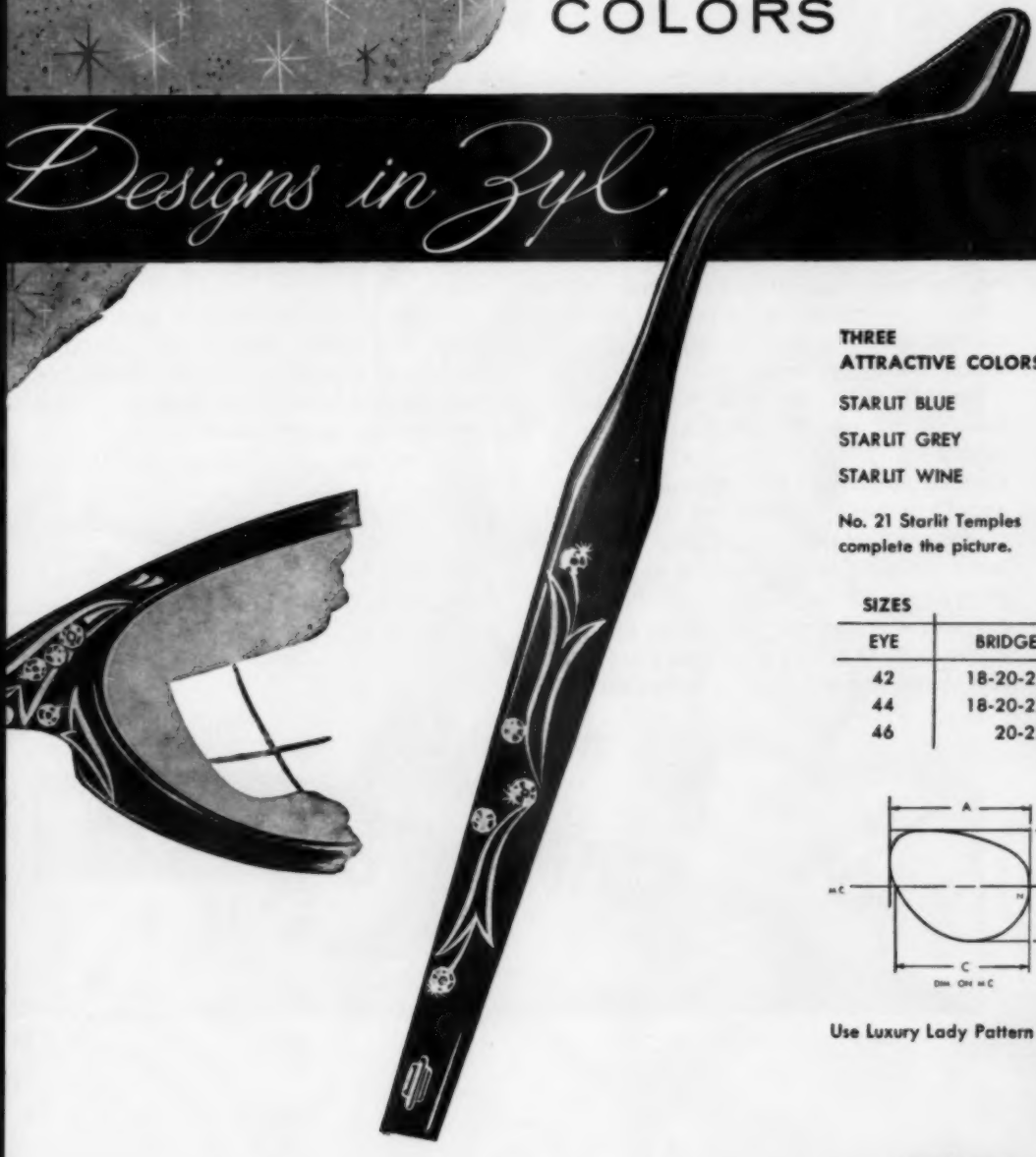

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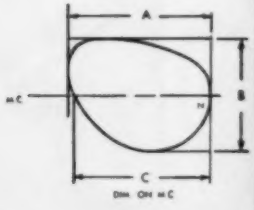

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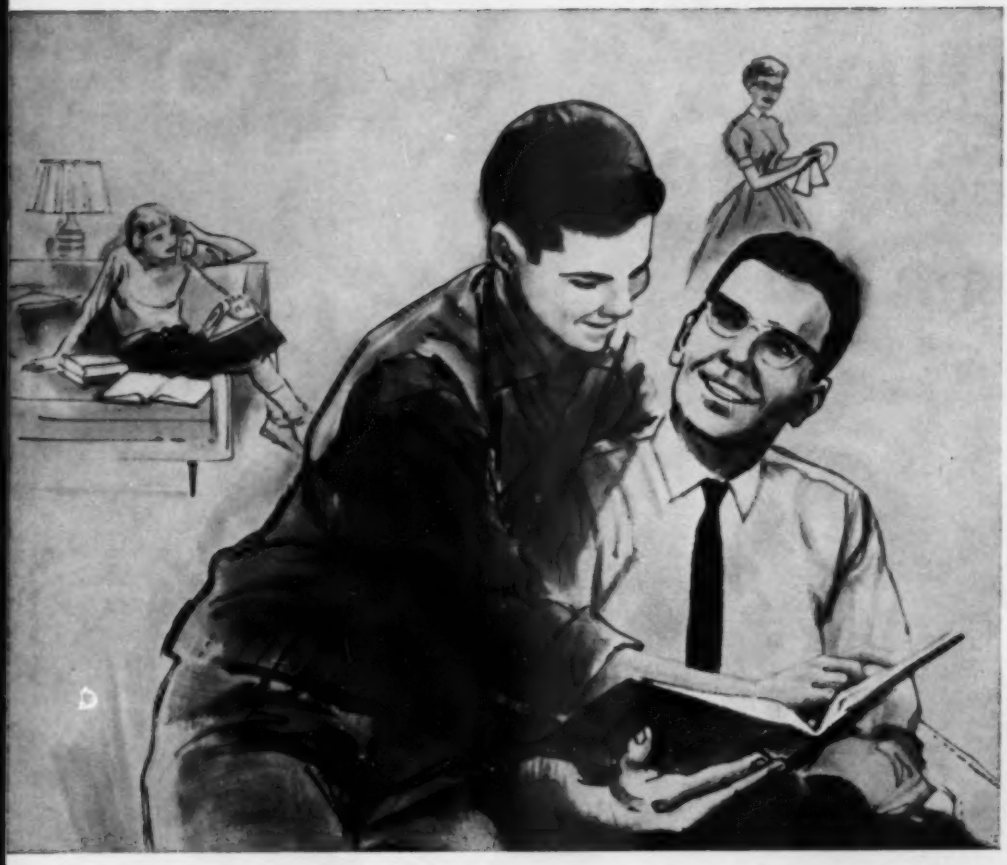

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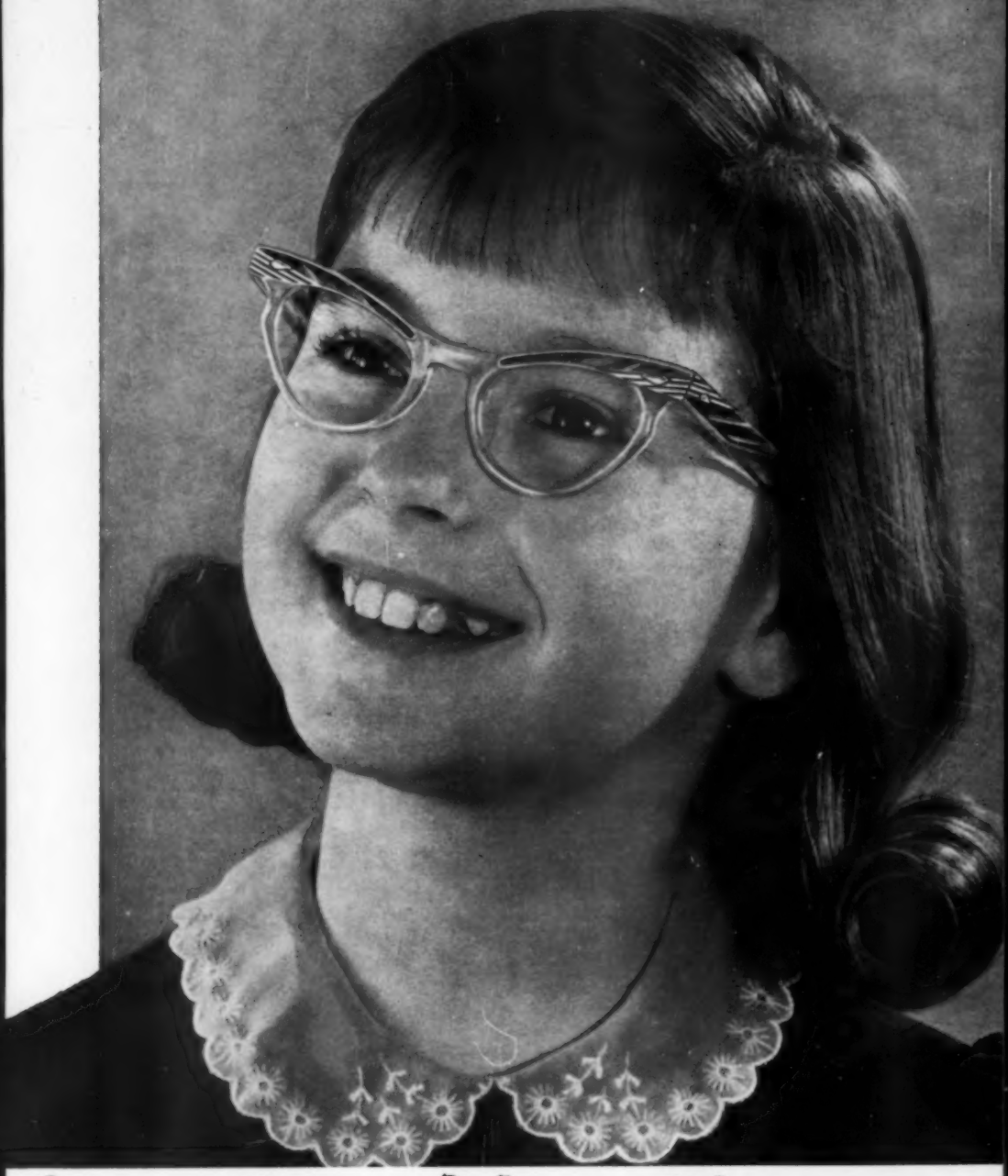

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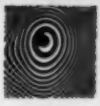

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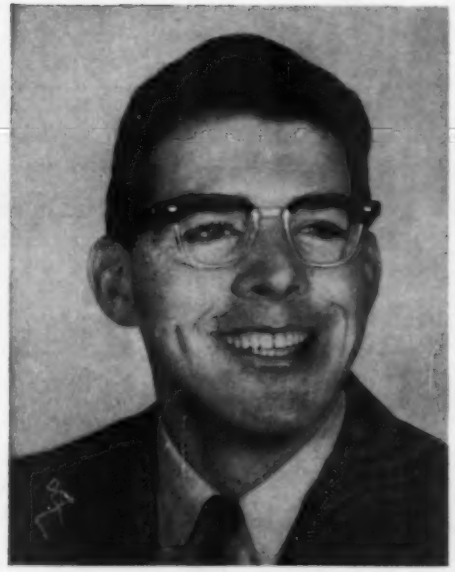

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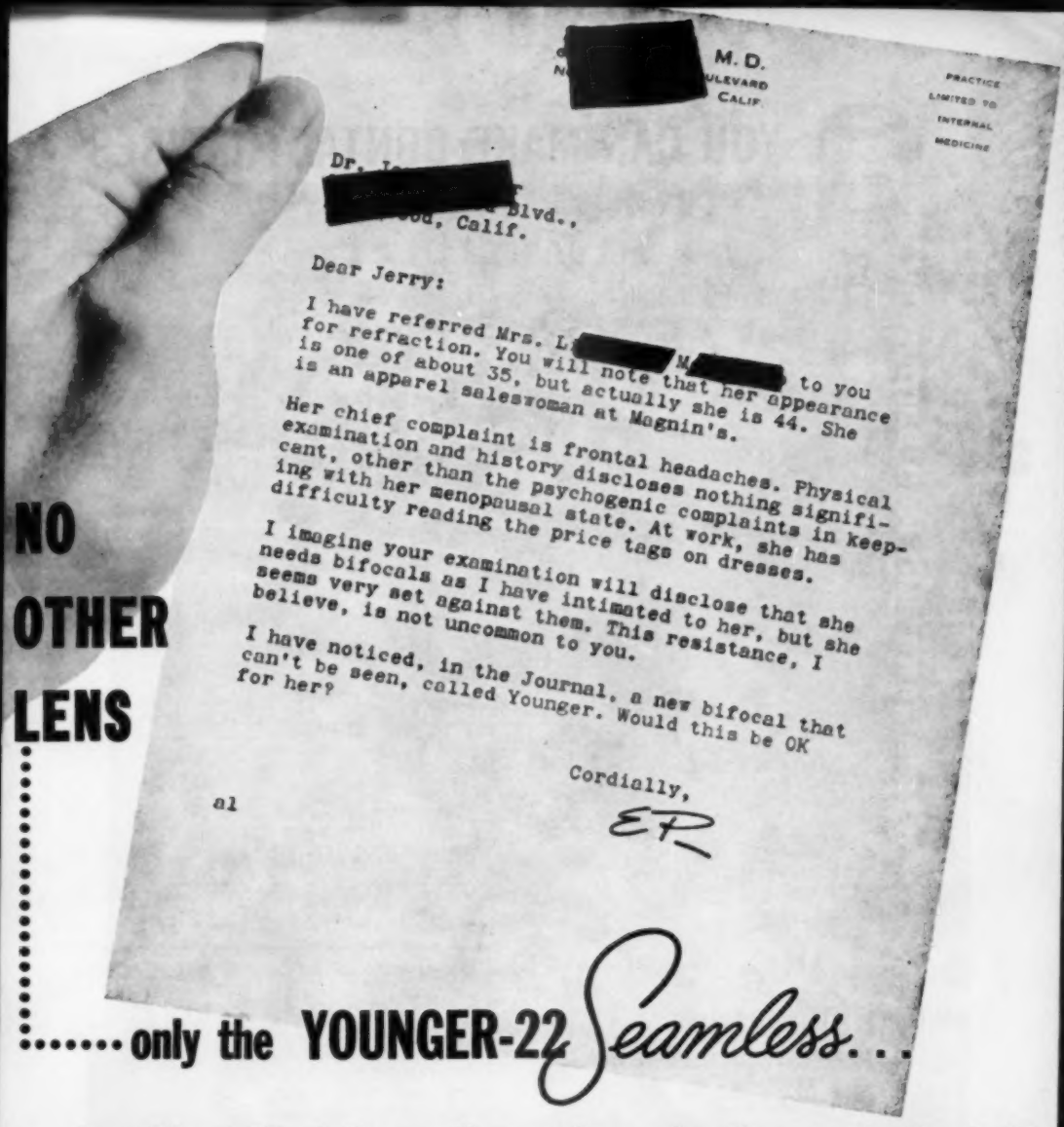
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Her chief complaint is frontal headaches. Physical examination and history discloses nothing significant, other than the psychogenic complaints in keeping with her menopausal state. At work, she has difficulty reading the price tags on dresses.
I imagine your examination will disclose that she needs bifocals as I have intimated to her, but she seems very set against them. This resistance, I believe, is not uncommon to you.
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Vol. 37 August, 1960 No. 8

RECENT DEVELOPMENTS IN BIFOCAL CONTACT LENSES*

George N. Jessen†
The Plastic Contact Lens Company
Chicago, Illinois

After over 500 cases of bifocal contact lenses, I'm beginning to see the light in bifocal lens design.

The same basic rules that hold true for successful single vision fitting hold true for bifocal contact lens fitting. The lens should be small enough to permit all day wearing time with comfort and eyes that are free from injection. It's thickness should be minimum and is quite easily calculated from our minimum thickness charts.

The chart for plus contact lenses is as follows: For a 9.2 diameter lens, the minimum thickness can be achieved by adding .007″ to the dioptric power in the contact lens. For example: If you had a +5.50 power in the contact lens, add .007 to it, your minimum thickness would be 12.5. For each additional .1 mm., it's necessary to add an additional .001″ in thickness; for each reduction in diameter of .1 mm., it's necessary to subtract ¾ of .001″. The thickness of your contact lens in a bifocal form must be calculated from the total reading power. For example:

If the prescription in your contact lens is to be +2.50 with a 3.00 add, then the power in your contact lens must be considered to be 6.00 and if you use a 9.2 diameter the minimum thickness lens would be .013″.

The thickness table for minus lens bifocals is .002″ more than the following table which is a good guide for single vision lenses:

Plano to —2.00	.007″
—2.25 to —4.50	.006″
—4.75 to —9.00	.005″
—9.25 and Up	.004″

You will see that there is some discrepancy in that a —.50 total power would have a thickness of .007″ in a single vision and .009″ in a bifocal form, while a +.50 in a bifocal form would only be .0075″. In these low powers, judgment must be used. A +.50 total power in a bifocal contact lens would have to be at least .008″ to .009″ for reasonably good optics.

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*Read before the annual meeting of the American Academy of Optometry, Chicago, Illinois, December 13, 1959. For publication in the August, 1960, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Fellow, American Academy of Optometry.

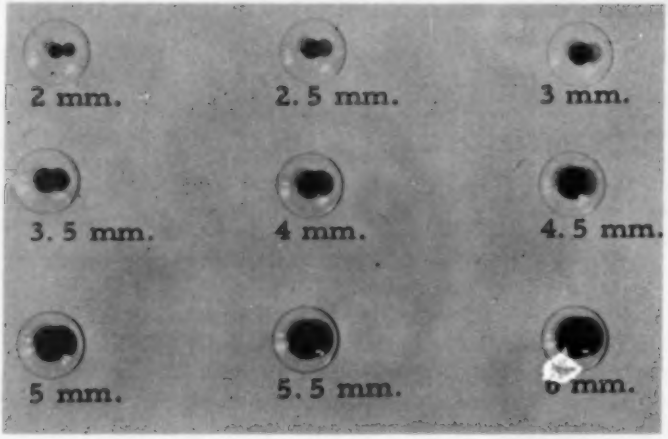

Fig. 1

In order to subjectively determine the minimum size central distance field that the patient could utilize, we painted opaque spots of various diameters from 2.00 mms. to 6.0 mms. on well fitting contact lens.

The minimum size that most patients could perceive was 3.5 mms., and it was very possible to read around this central occluder. Figure 1. Mathematical studies presented at the First World Contact Lens Congress by Yutaka Mizutani, M.D., of Japan, arrived at the same optimum diameter by calculation.

The situation of the test was to insert these lenses on an adapted patient. Then by means of a rheostat control, gradually increase the

Fig. 2

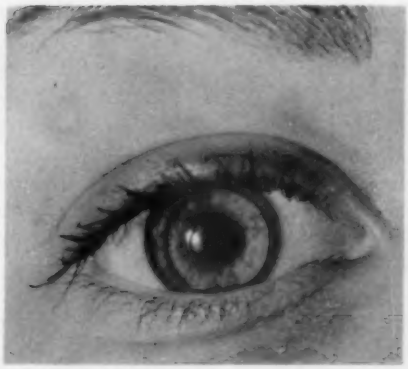

Fig. 3

intensity of 2 No. 2 photo flood lamps held 3 feet from the subject's face. As the illumination increased, the pupil constricted and we expected that gradually the spot would become more visible. Figures 2, 3 and 4. Much to our surprise, even in the highest intensity of illumination and the maximum pupil constriction, it was very difficult for the subject to see the opaque occluder when less than 3.5 mms. in diameter.

Analyzing the reasons for this inability to perceive the spot, the conclusions that we must draw are as follows:

First, it goes without saying that as the pupil constricts, we do not find a visual field construction. So the idea that in bright light the patient was looking through the central portion of a bifocal contact lens, only, must be discounted.

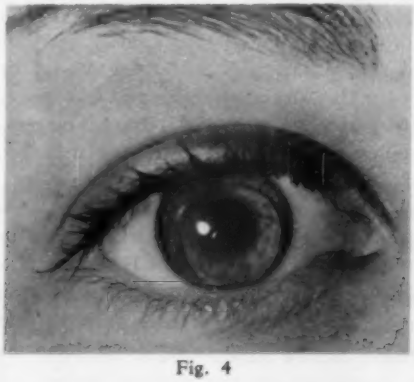

Fig. 4

We must realize that at all times, regardless of the amount of illumination, the patient is looking through both the central and peripheral regions of the contact lens, and that there must be some slight movement in the contact lens, allowing the patient to manipulate the lids and actually move the contact lens so that the distance or the peripheral optical portion is placed over the visual axis as the need arises.

As we fit lighter, thinner, smaller lenses, this can be accomplished by the slight narrowing or widening of the palpebral aperture, and the patient readily learns to accomplish this eyelid gymnastic.

The second conclusion we must draw from these opaque spots, is that they act in the same fashion as an opacity on the cornea itself. There is a loss of illumination, but there's no loss in resolution. We have all seen people with a leukoma, but an otherwise regular cornea. These people can frequently read 20/20 even though the leukoma encroaches upon the central area of the cornea. An example of this would be to take a common projector chart and place a coin against the lens. You don't blot out or create a circular shadow, but you merely reduce the intensity of the illumination, and this is achieved also by the spot on the contact lens or the leukoma on the cornea.

Figure 5 will show some of the efforts made in the past two years in bifocal design. First, you will see the early Bicon. The distance optical portion was 4.0 to 6.0 mms. and generally it was necessary to increase the add as much as 2.00 to 3.00 diopters over the patient's spectacle lens, to achieve even a fair amount of reading ability.

The second type of bifocal was the de Carle bifocal, which has its bifocal portion on the concave side, which rests in close proximity to the cornea. This bifocal is ingenius in design because at first blush the experienced fitter is generally shocked to learn that in a 2.25 diopter add, there is a 7.00 diopter difference between the central far point portion of the lens and the peripheral near point portion. Our first reaction to this situation is that there would be a big bubble in the area or perhaps the cornea would swell into this area, and create a considerable distortion or spectacle blur. To our surprise, neither the bubble nor the corneal swelling occurred and the reason, of course, is that if this area is 3.0 mms. or less in diameter, its sagittal depth is in the neighborhood of .002" and tears fill this tiny depression and there just isn't room for a bubble or corneal swelling.

The third type of bifocal is a Chester J. Black bifocal which resembles an old up-curve or read-rite type spectacle bifocal. The distance portion is in the upper hemisphere and the reading portion is in the lower hemisphere. To keep this bifocal from rotating, Dr. Black

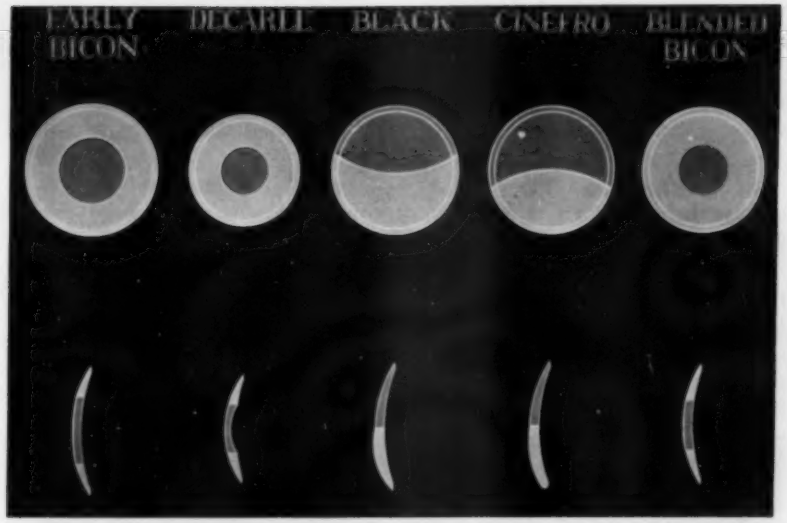

Fig. 5

weighted the reading portion by means of 1.00 prism diopter and gravity does the rest. From this bifocal approach it became possible to fit and correct moderate amounts of hyperphoria with contact lenses. The basic philosophy behind this type of lens was that since a great percentage of patients who were candidates for bifocal contact lenses were hyperopic, and since frequently hyperopic contact lenses would lag downward, the patient would be looking through the upper portion at far point and, therefore, not have the annoying diplopia effect that a lagging de Carle or a Bicon might afford.

The next step in the development was a Cinefro bifocal, which in effect, is a one piece bifocal of the ultex type which has its segment on the convex surface rather than on the concave surface, as in the case of most one piece spectacle lenses. In this bifocal, it is not necessary to grind prism or the pendulum effect. The add itself is of sufficient weight to cause it to gravitate downward, as in the Black bifocal. A lag is desirable because this places a patient's optic axis squarely through the far point lens.

Another type is the blended Bicon which is, in effect, a Sphercon lens with minimum thickness, which, because of its extremely light weight centers very well and because of the almost perceptible junction between the distance optical portion and the peripheral optical portion.

The patient is barely conscious of the annoying optical effect from the moving circular type bifocal.

The last type of bifocal is the triangular type, which is essentially a Chester Black bifocal with a weighted lower portion, in which the sides are tapered which has the effect of increasing the weight of the add portion.

In our opinion, the circular type bifocal has many advantages because the patient has reading ability upward, downward, inward and outward without resorting to ungainly neck postures.

All types of bifocals can be fitted extremely accurately by subjective and objective tests. The dispersion technique of centering contact lenses dates back into the era of haptic lenses.

If a projector chart target was seen to have a ghost image vertically, we know the lens lagged downward. If the ghost image, Figure 6, was seen to the right, then the lens lagged to the left, and it was not

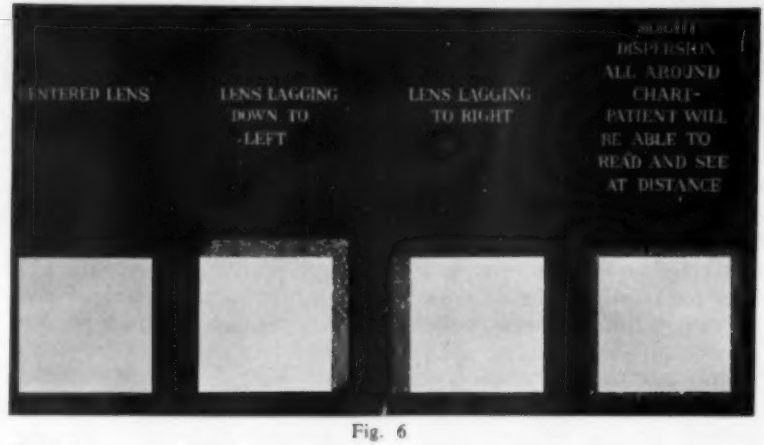
ENTERED LENS
LENS LAGGING DOWN TO LEFT
LENS LAGGING TO RIGHT
DISPERSION ALL AROUND CHART- PATIENT WILL BE ABLE TO READ AND SEE AT DISTANCE

Fig. 6

uncommon to have a lens that lagged down and in, or down and out. The projector chart is a subjective guide as to whether the distance portion of a bifocal contact lens is too large or too small.

If the chart is entirely free from dispersion, then generally the distance portion is too large. There must be at least ¼ to a ½ inch of ghost image preferably on all 4 sides of the chart. If the ghost is only on 1 or 2 sides, then the lens centers poorly. Without this ghost image on the distance chart, the patient is seldom able to read at near point. If the ghost image is 1½ to 2 inches or more in size, then the near vision is excellent, but the far vision is generally unacceptable to the patient.

By means of the retinoscope you can confirm this dispersion scene subjectively. If the patient has over a +1.50 add and your working distance is 26" or more, then as the patient fixates at infinity, he will scope a with motion in the central zone and an against motion in the peripheral zone. If the add was +1.50 and the same conditions held, you would have a with motion centrally and a neutral motion peripherally. With less than a 1.50 add, you would have a with motion in both zones, but the difference in speed of motion would be readily noticeable.

Retinoscopy is a sure-fire test for the centering of a bifocal contact lens and it also confirms the punctum proxima of the patient when used in the dynamic manner. A word of advice that may make the optical fit simpler is to be positive that every bit of plus lens that the patient will accept is incorporated into the distance prescription and under-correction at far point undermines the motivation of the patient and the morale of the fitter. The prescription of the reading add in the blended de Carle bifocal and in the blended Bicon is .50 diopter more than in spectacles. The reason for this is thought to be that as the plus lens is moved outward it gives a larger image and the patient needs slightly less add than in contact lens form.

When the patient is able to see 20/20 at infinity and at 16", he frequently manifests a depth of focus far beyond which would be possible in spectacles. This raises a point of doubt as to the need for trifocals even though they could be readily manufactured.

The physical fit of the bifocal contact lens must be at least as tight as the single vision lens. The tightness can be achieved two ways. either by making the lens larger or by making the lens thinner. We prefer to make the lens of minimum thickness and in a small diameter because that's our philosophy in the fitting of single vision lenses, and gives us the most consistent results and prolonged wearing time. Therefore, to fit a large bifocal lens means that these patients would achieve a drop in wearing time and also in appearance. From the cosmetic standpoint, nothing gives a clear white sclera, prolonged wearing time, normal head posture, and freedom from subjective symptoms that small thin lenses fitted on K constantly provide. The lens must be just tight enough that there is scarcely any movement with blinking, but that it must be loose enough that by a narrowing or widening of the palpebral aperture the lens can be positioned by the eyelids so that the patient can direct the visual axis through the central portion or the peripheral portion at will. Some patients achieve this simply by a neck movement such as is characteristically used in spectacle lens bifocal patients.

If the lens is loose, then our optical fit is complicated by the inability of the patient to keep the distance portion fixed causing the patient no end of disagreeable visual problems.

The method we use in fitting both the blended Bicon and the blended de Carle is to fit a single vision first and at the present time, we advocate the fitting of the reading lens first. Once I achieve comfort and the patient has worn this near point lens for at least 5 hours without signs of corneal insult, I then return the lens to the laboratory for the addition of the distance portion. This is done on the same lens and I'm finding the distance portion of a de Carle type of bifocal is easier to add successfully. The reason for this is because the difference in radii of curvature is considerably greater when the internal surface is utilized as the bifocal surface because the effective index of the internal surface of a contact lens is the difference between the index of plastic 1.49 and the index of tears 1.33, or a net of 0.16. For the effectivity of the convex surface of the contact lens is the difference between the index of air and 1.49. So, you need approximately 3 times the dioptric difference to achieve the proper correction in a de Carle type bifocal. For example: If the total reading add is +5.00, and the patient needs a +3.00 add, the distance portion will neutralize approximately 9.00 diopters more minus than the add or a —4.00 diopters.

To understand what adjustments are necessary, you merely listen to the patient. If the complaint is about distance vision, a larger central area is the answer. If the complaint is of near vision, a smaller central area is the answer. If hazing, stinging, and burning are the problems, then the lens is too large or too tight. If reflections and rapid changes in far point acuity is the problem, then the lens is too loose. If the lens is too tight, our choice of adjustment is generally the addition of more peripheral curve. We use a 12.25 mm. radius for this adjustment, and we blend the junction between the curve and the central radius carefully. If the lens is too loose, our general choice of adjustment is to make the lens thinner. A thin lens will adhere to the eye more securely and center better and at the same time not create any of the wearing problems we find with larger lenses. The final size of most well fitted bifocal contact lenses will be a maximum of 9.4 and frequently as small as 8.6.

The central optical zone is seldom smaller than 3.0 mms. and seldom larger than 3.5 mms. The acuity is generally 20/20 at both far point and near point in any patient where it's possible to achieve this with spectacles. The reading performance would be slightly less than in spectacles, but generally acceptable to the patient. The junction

between the far point and near point curve must be almost imperceptible. A straight sharp line junction will give rise to reflections and diplopia just as the straight sharp lines do in spectacle lenses.

Sympathy, concern and restraint have to be manipulated by an expert bifocal fitter. This is without a shadow of a doubt the most exasperating facet of a contact lens practice, but in the long run it will be the most rewarding.

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ANNOUNCEMENT

ASSOCIATION OF SCHOOLS AND COLLEGES OF OPTOMETRY

Dr. Herbert G. Mote of The Ohio State University School of Optometry, president of the Association of Schools and Colleges of Optometry, recently appointed the members of the A.S.C.O. Industrial Liaison Committee for the coming year. They are Dr. E. J. Fisher, College of Optometry of Ontario; Dr. Lawrence Fitch, The Pennsylvania State College of Optometry; Dr. Ralph H. Green, Massachusetts College of Optometry; Dr. Henry W. Hofstetter, Indiana University Division of Optometry; and Dr. Frederick W. Hebbard, The Ohio State University School of Optometry, chairman.

This committee was given two assignments at the annual A.S.C.O. meeting in Atlanta. One of these is to make a survey of 800 companies in industry to determine their needs for employing graduates trained in optometry, physiological optics, geometric optics, ophthalmic optics, etc. The results of this survey will be made available to all schools and colleges of optometry.

A second assignment is to explore the possibilities of receiving industry-wide financial support for optometric education. This country is increasingly realizing the vital importance of education, and industry in general has taken the leadership in assuming wider support for education at all levels. Such support is not only valuable in developing the brainpower needed to maintain a strong and free society, but it is also of direct help to industry, by providing better trained graduates for use in industry, and by showing the public that industry in general voluntarily realizes its responsibilities both in broad areas and in areas in which there are closely related interests.

PERIMETRIC SCREENING FOR GLAUCOMA*

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INTRODUCTION

The addition of a five-minute visual field screening to the normal refracting procedure in patients over 40 can reduce, materially, the number of undetected cases of glaucoma. Estimates of the incidence of glaucoma in the general population vary widely—from 0.7 to 7 per cent.[1, 2a, 3, 4a] Regardless of which figure may be found to represent a true picture, there can be no question but that this disease is a major cause of blindness. In this country one in eight cases of blindness is attributable to glaucoma, and an annual incidence of 3,500 new cases of blindness from this cause has been estimated.[4b] Clearly, it is a challenge to the optometrist to do his part in the reduction of the number of undetected cases of this disease in the population.

Of the three broad types of glaucoma—acute, secondary, and chronic simple—the first may be excluded from consideration here. It is extremely unlikely that an individual with an acute attack of glaucoma would present himself for an optometric eye examination. Further, should this occur, the decision for referral would be obvious and immediate. While secondary glaucoma is hardly as obvious, it generally presents sufficient other evidence of the primary disease to permit a basis for referral. Chronic simple glaucoma, unfortunately, is not only the most prevalent type but also is the most difficult to detect. There is ample authority for the statement that there is no single test, or combination of tests, that will detect all cases of early glaucoma—even in the hands of the most careful examiner.[5, 6]

SIGNS AND SYMPTOMS OF CHRONIC SIMPLE GLAUCOMA

Although the early detection of simple glaucoma is a difficult clinical problem, a number of signs and symptoms have been discovered which are more or less helpful. In order to estimate the frequency and usefulness of these clues, the records of 100 glaucoma patients were analysed. These records were selected to include *only* cases of previously undiagnosed chronic simple glaucoma. Further, the information tabulated was restricted to that dating *prior* to a positive diagnosis, as established by the institution of positive anti-glaucoma therapy. In short, the question was asked, "What information led to a diagnosis

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†Optometrist. Palo Alto Medical Clinic.

of glaucoma for this patient?". It must be stated here that since no absolute basis exists for the diagnosis of glaucoma, the results of these data represent a moderately conservative viewpoint. Further, since no rigid routine of examination was followed, it may well be that some observations went unrecorded. However, the intent here is not to establish statistical indices of frequency with so limited a sample, but rather to indicate the general trends in clinical evaluation which have led to positive diagnoses. N-100

Symptoms Reported	
Blurring	54
Pain, Asthenopia	27
Morning Headache	4
Halos	2
Reduction of Accommodation	2
Visual Field Defect	4
Refraction	
Hypermetropia (equiv. sph. greater than +1.00 D.) includes 2 patients with aphakia	38
Emmetropia	43
Myopia (equiv. sph. greater than —1.00 D.)	14
Not Recorded	5
External Examination	
Mydriasis, anisocoria	14
Injected conjunctival vessels	0
Shallow anterior chamber	15
Increased digital tension	7
Ophthalmoscopy	
Disc pallor	21
Disc cupping	41
Undermining of the disc	7
Visible Lamina Cribrosa	16
Visual Acuity	
Reduced corrected acuity—not explainable on the basis of observable changes in the media or retina	44
Tonometry	
Increased intraocular pressure (includes provocative testing)	93
Perimetry	
Glaucomatous field defect	72
Enlarged blind spot	49
Nasal step	31
Arcuate scotoma	24
Overall constriction	9
Temporal defect	2
Not taken	4

Age			
5-14	1	55-64	28
15-24	0	65-74	35
25-34	2	75-84	16
35-44	3	85-94	1
45-54	14		

Accepting the fact that these 100 patients are not necessarily "early" cases of glaucoma, but rather glaucoma at its earliest stage of detection, one can still take a hard look at the relative frequencies of the classic

signs and symptoms of this disease. None can be ignored, of course, but many seem to be noteworthy for their infrequency. Symptomology is obviously an unreliable diagnostic clue. The majority of these patients had complaints that were indistinguishable from a comparable group of purely refractive cases. The refractive state was only slightly more helpful. While there was a greater incidence toward the hypermetropic end of the scale, more than half of the patients were essentially emmetropic or myopic. The external examination shows some contribution to the picture of glaucoma, but largely as a clue for increased suspicion. The absence of all of the listed signs would hardly reduce the likelihood of this disease in a *given* patient. The ophthalmoscopic picture was more significant. Although the notation of disc cupping included the physiological as well as the pathological, advanced cases showed the signs of atrophy to increasing degrees. Loss of acuity also showed increasing frequency in the more advanced cases. Far above the rest in significance, however, were the clues of age, perimetry, and tonometry.

Fundamentally, a diagnosis of glaucoma must be based on evidence of increased intraocular pressure and visual field changes. That both of these conditions may occur in the absence of other signs and symptoms is obvious. That their measurement is so difficult and infrequent is unfortunate. Optometric tonometry presently is restricted to digital tonometry and scleral tonometry. The digital method is notoriously inaccurate and, even with the most experienced of digits, rarely detects any but gross elevations of pressure.[2b] Scleral tonometry, while subject to all of the sources of error inherent in such indirect methods of measurement, provides a more accurate guide to the intraocular pressure. In experienced hands, and utilizing provocative testing, it should prove quite helpful. This instrument has not found widespread use as yet, however. On the other hand, every optometric office should (and in California is required to) contain an instrument for measurement of the visual field.

Unfortunately, a careful visual field examination is lengthy and fatiguing for both the patient and the examiner. Twenty or thirty minutes may be spent in one examination—and it is not unusual that repeated testing is required. To demand this of every patient is neither necessary nor desirable. To neglect it in all but highly suspicious cases is indefensible. Obviously, those patients showing reduced acuity or clearly suspicious ophthalmoscopic signs must be exhaustively tested, but the prevalence of glaucoma in those *not* showing these signs is sufficiently great to merit the testing of a much larger group. For

practical reasons, this requires a modified approach. First, the group should be selected to include those most likely to have glaucoma and, secondly, an abbreviated form of testing should be used.

BASES FOR VISUAL FIELD SCREENING

Age provides the basis for selection of the screening group. All studies have shown a markedly increased incidence of chronic simple glaucoma in the post-forty age group.[2b, 7] Of the 100 cases cited here, only six were less than 45 years old.

The characteristic scotomata of glaucoma provide the basis for the abbreviated testing procedure. These scotomata are, fortunately, so characteristic that laborious searching is not necessary. They are variously named in honor of their discoverers, but generally fall into four patterns (Figure 1): 1. the nasal step, 2. the arcuate defect, 3. the en-

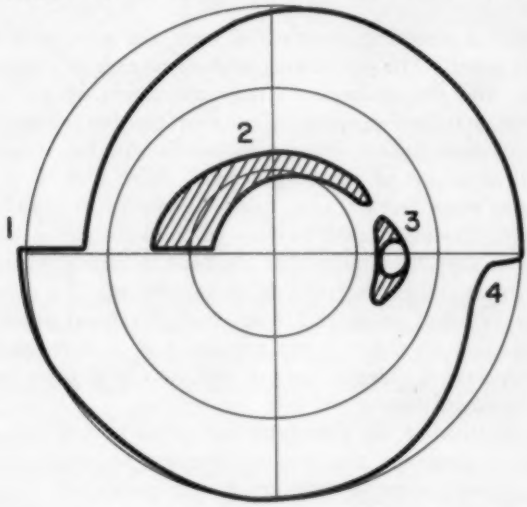

FIG. 1 CHARACTERISTIC SCOTOMATA OF GLAUCO

larged blindspot, and, late, 4. the temporal depression. All but the latter are usually found in the upper field and represent a relative loss of sensitivity of the lower temporal fiber bundles of the retina. A perimetric screening for glaucoma need not require the laborious measurement of numerous isopters with various target sizes and colors and the careful combing of all interior areas for isolate scotomata. In its most

elemental form it consists of the rapid testing with a single test object of these limited areas in which the characteristic glaucoma losses occur.

The closest approach to a visual field screening technique to be widely used is that employed in the Harrington-Flocks Multiple Pattern instrument.[8] This is a carefully designed device and is reasonably rapid in use, but is subject to at least five limitations: 1) the necessity of purchasing an additional instrument, 2) the restriction of the area under test to a fixed pattern, 3) special problems with aphakic patients, 4) the necessity of shifting to another instrument for more intensive testing, and 5) serious limitations in the detection of enlargement of the blindspot. The techniques employed by this instrument can be transferred, however, to the more widely used—and more useful—tangent screen.

TECHNIQUE

Although a screening approach is used, the niceties of perimetry should be observed. The positioning and instruction of the patient, the illumination, and the deliberate, steady movement of the test object should follow standard practice. Choice of the test object will vary with the individual patient and testing conditions, but should be such as to provide an isopter of 30 or 40 degrees. With 4 ft./c. of illumination and a one meter test distance, this will usually be found to be the 2 mm. object. Testing should be done through the patient's correcting lenses, but care should be taken that the head is turned when necessary to prevent the edges of the frame from interfering. To save time the patient may be asked to cover his eye with his hand or an occluder. It is not necessary to mark or pin the screen at each point of appearance or disappearance. Mental note of each may be made—for charting at the conclusion of testing the eye.

With a patient in the post-forty age group in whom there are no specific signs of glaucoma, the most rudimentary approach may be used. With the patient properly positioned and instructed, and one eye occluded, eight points of appearance are quickly checked—those marking the limits of a 30-40 degree isopter on either side of the vertical and horizontal meridians (Figure 2). Next, the size of the blind spot is checked at four to eight points. Finally, the area between the 10 and 20 degree rings is rapidly combed for signs of dimming or disappearance of the test object. The other eye is then occluded and the procedure repeated. If there is any indication of a field defect, one would immediately proceed with a thorough and careful examination. Finding none, however, an experienced examiner can conclude the procedure within five minutes, given a patient of average intelligence and reliability. The

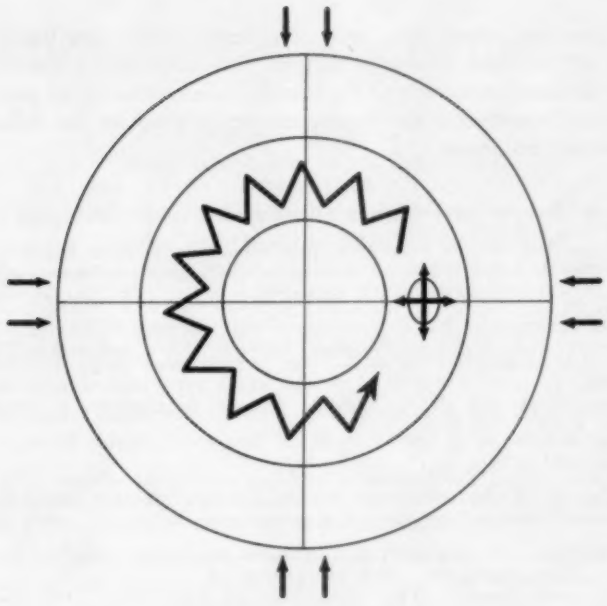

FIG. 2 PATTERN FOR VISUAL FIELD SCREENING

results may be recorded, simply, as a notation "screening field negative." More useful would be the recording of the positions found on a standard visual field chart. In this event, care should be taken that the chart is marked to indicate that it was a screening procedure and not a standard careful field.

CONCLUSION

Such a screening procedure as outlined runs the calculated risk of all screening examinations and will fail to identify some cases. Nevertheless, since it is manifestly impossible to subject every patient to a "complete" examination (if such could be said to exist), it is perhaps better that we administer a more limited form of examination to all that fall within the logically suspect age group—rather than restrict ourselves to the exhaustive examination of those few who show other positive signs of the disease.

In summary, glaucoma is a significant cause of blindness which is largely controllable when identified. The disease is notorious for the absence or unreliability of its signs and symptoms. This, in fact, constitutes its primary danger. Of the various signs, the patient's age, intra-

ocular pressure, visual field, and, to a lesser extent, ophthalmoscopic picture are the most reliable indicators. The addition of a quick five-minute perimetric screening to the examination routine of all post-forty age patients constitutes an effective minimum program for optometric detection of this disease.

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ANNOUNCEMENT

GESELL INSTITUTE OF CHILD DEVELOPMENT

The Gesell Institute of Child Development, 310 Prospect Street, New Haven, Connecticut wishes to announce that it is now considering applicants for its first postgraduate course in vision. The course, *Vision —The School Age Child*, Course I, will be a comprehensive study over an eight months period of time, from September, 1960, to June, 1961. The registered optometrists will participate in clinical and lecture sessions 2 days a month, some of these on an individual or semi-individual basis. The course conducted at the Gesell Institute will be limited to 12 optometrists. Further information may be secured by writing to the Visual Department at the Gesell Institute.

PARALLEL ALLEYS AS CLUES TO THE CONSTITUTION OF VISUAL SPACE*

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The alley problem deals with the age old observation that parallel lines forming an alley such as a tree-lined straight road or a railroad track are *sensed* as being parallel extended but are actually *seen* as converging toward a distant vanishing point. Investigators, such as Hillebrand and Blumenfeld, set themselves the task of constructing alleys which could be *seen* parallel directed and non-converging. Some few of these experiments were made monocularly while most of them dealt with binocular inspection. Efforts were made to reduce the surroundings by means of shields, slits and other artifacts. This was done in an effort to find an "inherent" faculty in space appreciation. In all these investigations the constructed alleys were formed by horizontally extended threads on a table top 4m. in length or by two rows of adjustable lights extending horizontally toward the observer's face. Threads or lights had to be aligned to form a non-converging parallel row. The observers ran into two difficulties:

1. The elimination of the habitual surroundings interfered with the *horizontal appreciation* of the alleys during *monocular inspection*, and

2. Extending the alleys directly toward the observers face during binocular inspection, introduced problems of *physiologic diplopia* which were formidable.

My personal approach to the alley problem was therefore somewhat differently oriented: The question I tried to answer was this: In what manner does an actual alley which is seen *monocularly* as parallel and non-convergent differ from an actual alley seen *binocularly* the same way when inspection is permitted in as *normal* a situation as possible.

For the above purpose I modified the original Hillebrand method of 4m. long threads stretched across a table toward the observer's face by using two *stout six foot strings* stretched horizontally from a fonto-parallel wall toward my chin. The loose ends of these strings were held in such positions that the strings were *seen* as an alley having a constant width all the way from the wall to the face.

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Read before the Spring Meeting of the Optical Society of America, Washington, D.C., April 8, 1960.
†Optometrist. Sc.D.

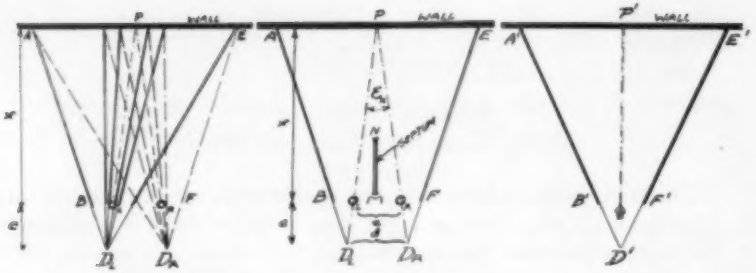


Fig. 1, (left). Fig. 2, (center). Fig. 3, (right)

These judgments had to be made while the alley formed by the two strings was centered on the viewing eye (or eyes) with the *head remaining fixed and immovable*. This meant that for left eyed inspection, the near ends of the strings had be be held under the left eye and had to be shifted a full P.D. toward the right for right eyed inspection. The figures 1, 2, 4 and 7 represent the *top view* of various experimental situations. The heavy black lines denote the wall, six feet from the observer, whose two eyes are represented by the small circles marked L and R. The dot-and-dash lines show the eyes directed toward P at the wall. In all these figures the scale of the abscissa is about five times that of the ordinates so that the widest double lines of Figure 1 represent six foot strings which have a wall spread of 14 inches and are only 2½ inches apart directly below the *viewing left eye*. Two other alleys, viewed via this eye alone are shown by the remaining double

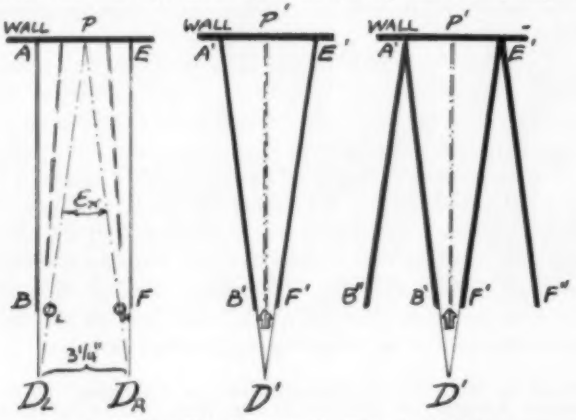
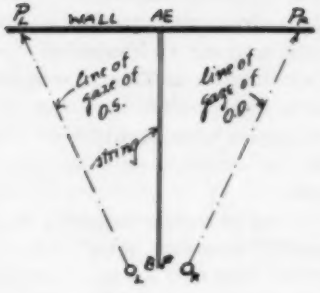


Fig. 4, (left). Fig. 5, (center). Fig. 6, (right)



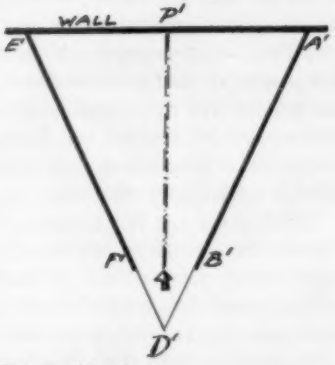
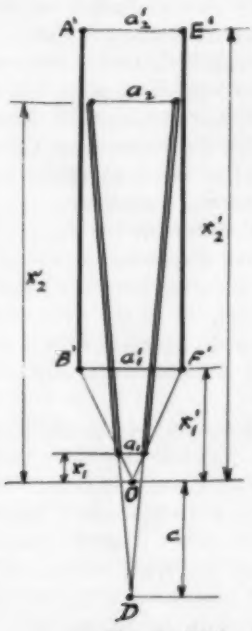
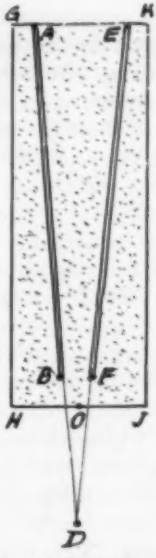


Fig. 7. (left). Fig. 8. (right)

lines in Figure 1. It was found that all these, any many others, had to be spread approximately five times as far at the wall than at the face in order to be seen as parallel six foot alleys. This was in good agreement





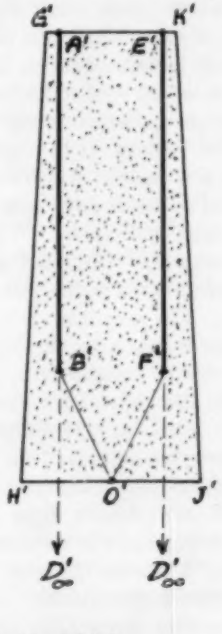


Fig. 9. (left). Fig. 10. (center). Fig. 11. (right)

with the findings of earlier investigators. If the experimentally established *actual* string positions are plotted, the backward extensions of the plotted lines which represent these strings, intersect each other to form cluster points around *a single locus D* which is located about seventeen inches behind the viewing eye. This locus D represents some sort of a *posterior vanishing point* for alleys which are seen parallel and non-convergent. It was noted that varying the direction of gaze had no noticeable influence on this alley awareness.

In Figure 1 the fan extending from the posterior vanishing point D_L shows the strings in position for parallel awareness via the left eye. It was found that an exactly similar fan extended from a posterior vanishing point D_R which served the same purpose for the right eye. The relationship between these two fans was found to be Euclidean and in full agreement with the geometry shown in the Figures.

In order to duplicate the experienced monocular awareness exactly during *binocular* inspection, it was necessary to provide a median septum between the extended strings to prevent the left string from being seen via the right eye and vice versa. For these judgments two conditions were made standard, namely (1) that the angle of convergence should remain unaltered and (2) that the convergence distance should remain equal to the length of the strings. No limitations were set in regard to direction of gaze, although, for obvious reasons, a symmetrical convergence was chosen for the geometric presentations shown in the Figures. *The actual* string positions for the binocularly viewed alleys of various width which were appreciated as non-convergent, were found to be *directly related* to those for monocular awareness of alleys of equal wall-spread. Thus, the actual position for the left string AB of the widest alley in Figure 1 during left eyed inspection, was exactly identical with string position AB of Figure 2 during binocular inspection. The same held true for the actual position EF of the right string of the widest alley in Figure 1 during right eyed inspection since it was exactly the same as string position EF in Figure 2 for binocular inspection of an alley of equal width.

It was quickly discovered that the median septum was totally unnecessary provided that, in binocular awareness, *full use was made of the existing physiological diplopia of the two extended strings.* The unbroken double lines of Figure 4 represent two actually parallel directed strings in their *actual* relation to the two eye stations O_L and O_R. With binocular fixation maintained at P, on the wall, the cyclopean relationship as shown in Figure 6 is in full accordance with the rules governing physiologic diplopia. This relationship decrees that the two

half-views of each diplopic string should converge and meet at the wall and this is the way they are actually seen. However, the inner legs of the M-shaped figure shown in Figure 6 are much more prominent during binocular inspection than are the outer legs. There is experimental evidence that these inner legs are *naturally* chosen for parallel alignment even when the observer is not aware of the existing diplopia. It was found that the *actual* string position was exactly the same for this diplopic awareness as for the single awareness shown in Figure 5 when the median septum was replaced.

A different manner of obtaining a parallel perceived alley was that of using a *single string* which was extended horizontally *along the midline* of the head toward the observer's chin. Strong base-out prisms were used to force the lines of sight into sufficient divergence so that the left half view of the centered string formed the right side of a parallel perceived alley while the right half view of this same string formed the left side of the perceived alley. Figure 7 shows the actual situation (minus the prisms) and Figure 8 shows the binocular awareness solely as determined by the rules governing retinal correspondence. Since, in the above situations, these rules also determine that the width BF at the face must be equal to the inter-ocular distance, it could be ascertained that the spread of gaze at the wall, as shown in Figure 7 by P_L and P_R was exactly equal to the wall spread AB of a monocularly perceived alley if the spread EF, at the face, was also equal to the observer's P.D. By introducing large amounts of extra prisms, the eyes could be forced into very considerable *convergence* while an effort was made to retain perceptual parallelism. *Such added convergence did not alter the prior established geometric relationships.*

For the above reasons the experimental findings could be *mathematically formulated* in accordance with the Euclidean geometry shown in the appendix.*

Suffice it to say that for the transformation of "monocular" space into a binocular space as determined *solely* by the rules of retinal correspondence, a sort of *"reduced physical space"* had to be established in which the *two eyes could have a single representation* and in which length ordering remained the same as in actual space. This is shown in Figures 3 and 8 in which the cyclopean eye station is represented by an arrow to show that it is unreal. In this "reduced" physical space parallel perceived alleys of a given width at the wall, have *identical string positions* with alleys of similar width viewed monocularly. All of them, without exception, converge toward a single posterior vanish-

*See Appendix.

ing point which is located a short and constant distance behind the effective eye station. Inasmuch as this vanishing point is the same for monocular inspection in physical space as for binocular inspection in the "reduced" physical space, the final change from these two types of cubic space to a pyramidal type of visual space which permits diverging strings to be seen parallel directed and parallel strings to appear converging, becomes *one and the same problem.*

Two more points need to be made: (1) By means of fastening two strings to a *single* wall attachment, an alley can be formed which perceptually has zero width. In this perception the left half-view of one string is *fused* with the right half-view of the other string. It was found that *such "fused" alleys no longer follow the rules determined by retinal correspondence but that they are subject to equally well definable rules governing fusional processes.*

(2) Glenn Fry, head of the Optometry School of the Ohio State University, to whom I sent my experimental findings and whom I asked whether the above discussed transition from physical to visual space could be mathematically formulated, *did* find that such a formulation was possible if (A) the Helmholtz-Gullstrand formula was used to relate physical distances with perceived distances by a constant k for any given landscape, and if, (B) the Euclidean assumption was made that perceived angular size is equal to perceived linear size divided by perceived distance. Under the above conditions Glenn Fry mathematically showed that the distance of the posterior vanishing point is indeed a constant, namely the reciprocal of k, both for monocular and binocular space as based on the premises here presented. These calculations are shown in the Appendix.

Note: Much of the supporting data and material are contained in the author's published *Visual Training III* which deals with Binocular Vision in its normal and abnormal aspects.*

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APPENDIX

Figure 1	O_L	=	Left eye position
	O_R	=	Right eye position
Monocular	AE	=	Alley width at wall = a
Alley	D_L	=	Posterior vanishing point for alleys seen via left eye
	D_R	=	Posterior vanishing point for right eye
	x	=	Length of alleys measured from face
	c	=	Distance of D_L and D_R from eyes

*Reprints of *Visual Training III* may be obtained through the author or through the Professional Press, 5 North Wabash Avenue, Chicago 2, Illinois.

P = Point of binocular fixation (far end of alleys)
BO_L = $O_RF = \frac{1}{2}$ b
b = Width of alley at face during monocular inspection
O_LO_R = Interocular distance = e
BF = e + b

Visual axes are represented by dot-and-dash lines.

$$\frac{b}{a} = \frac{c}{c+x}; \quad b = a\frac{c}{c+x} \qquad (1)$$

Figure 2
Binocular Alley

Σ_x = Convergence angle
MN = Median septum to conceal AB from OD and EF from OS
D_LD_R = Distance between vanishing points
= d

$$\frac{e}{d} = \frac{x}{c+x}; \quad d = \frac{c+x}{x} \qquad (2)$$

Figure 3
D′ = Combined centers D_L and D_R in "reduced" space
A′B′ = Left string in reduced physical space
E′F′ = Right string in reduced Physical space
▲ = Cyclopean eye station in reduced physical space

Note: In perceived (binocular) space A′B′ is parallel to E′F′.

Figure 4
Parallel Constructed Alley

AE = BF = D_LD_R: a = b + e = d
Since a = b + e, from (1)

$$\frac{b}{b+e} = \frac{c}{c+x}; \quad b = \frac{ex}{x} \qquad (3)$$

Note: A six foot parallel constructed alley has approximately 3¼ inch width while all narrower alleys are narrower at the wall than at the face.

Figures 5 and 6
Reduced parallel constructed alley

A′B′ and E′F′ converge on D′, the distance c behind the cyclopean eye station.
In figure 5 septum MN conceals left string from right eye and vice versa. Figure 6 shows diplopic construct in reduced space: A′B′ and E′F′ represent the left half-views of strings AB and EF while A″B″ and E″F″ represent the right half-views.

Figure 7
Single string with divergent eyes

AB = Single string as viewed via left eye
EF = Same string as viewed via right eye
O_LP_L = Line of direct gaze of left eye
O_RP_R = Line of direct gaze of right eye

(Prisms are not shown)

Figure 8
Parallel alley in reduced space formed by single string

A′B′ = Position of left half-view of single string
E′F′ = Position of right half-view of single string
D′ = Posterior vanishing point in reduced space
▲ = Cyclopean eye station in reduced space
▲P′ = Cyclopean line of gaze

Note: The above alley in reduced space is seen parallel directed.

Conversion of physical space into visual space by Glenn Fry:

Helmholtz-Gullstrand Formula

$$\frac{1}{x'} = \frac{1}{x} + k \qquad (4)$$

x = physical distance
x' = perceived distance
k = constant

$$\phi' = \frac{x'}{y'} \text{ (radians)} \qquad (5)$$

ϕ' = perceived angular size
x' = perceived distance
y' = perceived linear size

Equation 4 applies to monocular vision as well as to binocular vision. Dr. Fry provided Figure 9 to give an analysis of the effect which was obtained with one eye by the author. The eye is at 0. In order to see AB and EF as parallel lines, these must converge on D, a distance c behind 0. For BF and AE to be seen as equal the images must be projected to the distance x'_1 and x'_2.

$$\text{Since } \frac{1}{x'} = \frac{1}{x} + k \qquad (6)$$

and since we may assume that perceived angular size is equal to physical angular size, namely

$$\frac{a}{x} = \frac{a'}{x'} \qquad (7)$$

$$\frac{a}{a'} = 1 + kx \qquad (8)$$

Since $a'_1 = a'_2$

$$\frac{a_1}{a_2} = \frac{1 + kx_1}{1 + kx_2} \qquad (9)$$

Furthermore

$$\frac{a_1}{a_2} = \frac{x_1 - c}{x_2 - c} \qquad (10)$$

Solving 9 and 10 simultaneously, we obtain

$$c = \frac{1}{k} \qquad (11)$$

The distance c is a constant for a given environment.

The above mathematical formulation by Glenn Fry also provides that, if the constant k is zero, locus D moves to infinity. This means that lines AB and EF are seen parallel.

In conformity with step (I) or (II) a theoretical boundary GHJK has been established in Figure 10 for the strings AB and EF shown in Figure 9, strings which converge toward the posterior locus D. Since Figure 9 refers to a monocularly perceived alley, step (III) is not needed.

The final transformation, shown in Figure 9 by the change of the converging lines AB and EF to parallel directed lines A'B' and E'F', is depicted in Figure 11 together with enclosing boundary G'H'J'K'. This boundary is no longer cubic in nature but resembles the pyramidal visual space as described by Arnheim.

AN INFRA-RED OPTOMETER TO STUDY THE ACCOMMODATIVE MECHANISM*

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INTRODUCTION

Control of accommodation of the eyes could be either reflex or learned. To study the development of the control of accommodation in children, the infra-red optometer described in this preliminary report was designed. It will record accommodative responses as a visual task is being performed and without the subject being aware of the measuring device. To permit small eye and head movements it will include a corneal reflex tracking device to insure proper centering of the infra-red beam entering the eye. The tracking device will be described in a separate paper.

APPARATUS

Figure 1 is a schematic of the components of the infra-red optometer. The visual task indicated by the cartoon will be a motion picture target or other appropriate test material viewed by both eyes simultaneously. The lens F_2 in front of the left eye is a filter intended to make the appearance of the task seen by the left eye identical to that seen by the right eye through mirror M. M is characterized by a transmission band in the middle of the visible spectrum and a high reflection band in the infra-red and was made by partially coating a glass plate with metallic gold. Thus infra-red light from the task area cannot enter the eye because it is reflected at the mirror M, whereas infra-red light from the optometer source S is virtually all reflected into the eye. An infra-rd filter F_1 is used to eliminate the visible light from S. The light transmitted by the gold mirror appears green.

The source S is imaged in the plane of the pupil at S′ by the lens L_1. An aperture in front of the photomultiplier tube is imaged in the plane of the patient's pupil at A′ by lens L_2. The half-mirror immediately in front of L_2 is fully aluminized and covers one-half of the corresponding surfaces of lenses L_1 and L_2. Light which leaves the

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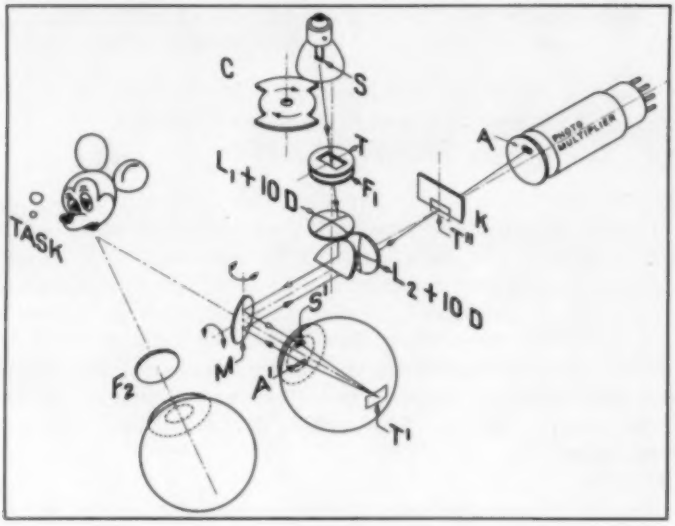

Fig. 1

source S can enter the eye only by way of the pupillary area S′ while light which leaves the eye by way of area A′ in the pupil will pass through aperture A and enter the photomultiplier tube. T is a target aperture consisting of a rectangular hole cut in a metal plate. Since it is placed at the focal point of lens L_1, it is imaged at infinity and is brought to a focus in the patient's eye at T′. T′ serves as a luminous object on the surface of the retina and is in turn imaged approximately at infinity by the optical system of the eye. It is then brought to a focus by Lens L_2 approximately in the plane of the knife edge K indicated by T″.

Increased accommodation of the eye will cause a shift downward of the image T′ on the patient's retina, which will cause a shift of the image T″ upward on the surface of the knife edge of K. If K is removed, all of the light forming the image T″ will enter A and excite the photomultiplier tube regardless of the status of refractive error or accommodative change in the subject's eye. With the knife edge in the path of the beam, increasing the accommodation causes more of the light to fall upon the surface K and results in a smaller output of the photomultiplier tube.

The arrangement of images S′ and A′ in the plane of the pupil eliminates the possibility that light reflected from the cornea will enter the photomultiplier since the source image S′ is never conjugate with the photomultiplier tube aperture A.

The rotating disc, C, interrupts the beam from the light source at high frequency and produces a pulsating direct current from the photomultiplier tube. This is fed through a band pass filter into an r.c. amplifier. To prevent saturation of the photomultiplier tube by ambient illumination, an infra-red filter is mounted in front of the phototube (not shown in the diagram) and a shield covering the top and sides of the face is provided.

The electronic circuit used to amplify the output of the infra-red photomultiplier is a commercially available 14 watt high fidelity amplifier[1] coupled to a preamplifier.[2] The output of the amplifier is full wave rectified and fed directly into a pen writer.[3] A constant voltage transformer is used to stabilize these components.

Figure 2 shows the wiring diagram and components of the stable

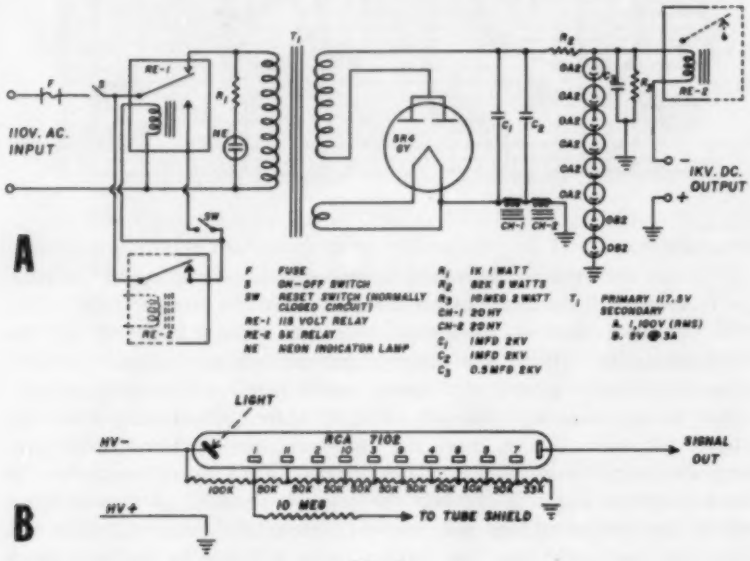

Fig. 2

power supply used to provide high voltage for the infra-red photomultiplier tube. Since the output of the photomultiplier tube can be increased by increasing the applied voltage as well as by increasing the amount of light, a stable power supply is absolutely essential. Several power supplies were built and tested and discarded in developing this one. The performance and regulation characteristics of this power supply are excellent.

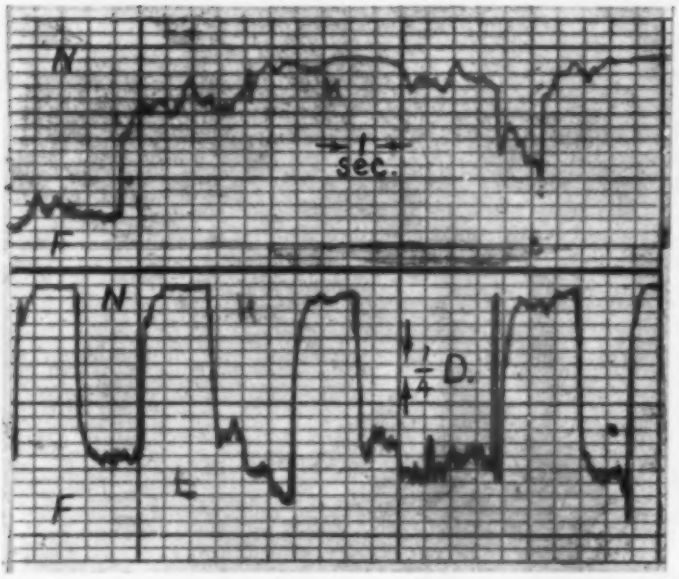

Fig. 3

CALIBRATION

Since the area on the retina illuminated by the image T′ is relatively very large, the effects of small elevations in the surface of the retina will have no effect in the overall refractive power indicated by the photomultiplier. With the arrangement shown in Figure 1, variations in refractive power in diopters would produce a directly proportional variation in the amount of light entering aperature A to the photomultiplier. To calibrate the output of the photomultiplier-preamplifier-amplifier-writer circuit in diopter units, a schematic eye is substituted for the real eye and the focus is changed in diopter steps while the output of the ink writer is recorded. Since the infra-red reflection characteristics of the human retina will not be the same from person to person nor the same as those of the retina of the schematic eye, it is necessary to measure the relative reflectance of the retina of the particular eye being tested. To do this the knife edge K is removed and the output of the photomultiplier with the schematic eye in place is compared to the output when the eye to be tested is in place. As long as the knife edge or the pupillary margin does not interfere, the output of the photomultiplier will be practically independent of the accom-

modative status of the eye under test. By adjusting the gain control of the amplifier, differences in reflectance between the human eye and the schematic eye are compensated and the dioptric calibration of the instrument becomes applicable to the human eye.

Figure 3 is a record of the accommodative change of a human eye as fixation was changed from far to near several times. The amplitude indicated is about 4 diopters and each horizontal scale division represents one second of time.

EQUIPMENT REFERENCES

1. Heath Kit High Fidelity 14-watt Amplifier, Model EA-3; Heath Company, Benton Harbor, Michigan.
2. Non-motorboating Resistance Coupled Amplifier (19-21), pg. 367. R.C.A. Receiving Tube Manual, Technical Series RC-19, Electron Tube Division, Radio Corporation of America, Harrison, N. J. Copyright 1959.
3. Massa 2 channel-3 speed Synchronous Drive Electrodynamic Recorder Model EA 1023, Massa Laboratories, Inc., Hingham, Mass.

ANNOUNCEMENT

THE CHILD IN OPTOMETRIC PRACTICE

"The Child in Optometric Practice" will be the theme for the Fall post-graduate conference at the University of Houston College of Optometry on Sunday and Monday, November 6 and 7.

The program will include lectures on all phases of children's vision, including refracting procedures, developmental vision care, visual training, strabismus, visual screening, contact lens fitting, and subnormal vision care. Lecturers will be members of the faculty of the College of Optometry, practicing optometrists, and guest speakers from other departments of the University.

A highlight of the Conference is the Fellowship Dinner to be held Sunday evening. The dinner will be followed by a panel discussion on the subject "The Role of the Optometrist in Developmental Vision Care."

Wives of optometrists also are invited to come and they are invited to attend any of the educational meetings. For the wives Houston offers many cultural activities, as well as excellent shopping facilities.

Dormitory space and meals will be available at the University Guest House. For further information optometrists may write: College of Optometry, University of Houston, Houston 4, Texas.

STUDIES IN FIXATION DISPARITY*

III. THE APPARENT UNIOCULAR COMPONENTS OF FIXATION DISPARITY

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In earlier articles the literature on fixation disparity has been reviewed[2] and the apparatus and procedure have been discussed.[3] The later article included a discussion of the problem of constant error with regard to the measurement of fixation disparity.

In the present experiment, the technique used to measure the apparent uniocular components of fixation disparity was similar to that of Ogle.[5] The physical misalignment of a monocular line necessary for perceptual alignment with a binocular line was determined. This misalignment was considered to be a measure of the uniocular component of the eye seeing the monocular line.

The apparent division of fixation disparity between the two eyes determined by any subjective technique will depend on the presence or absence of directionalization dominance of one eye over the other. On the basis of Ogle's discussion of the uniocular components of fixation disparity and the theory of ocular dominance proposed by Walls,[7] one would expect to find a relationship between ocular dominance and the subjective division of fixation disparity between the two eyes. Persons with a pronounced ocular dominance would apparently have all of their fixation disparity in their non-dominant eye. Those with a moderate ocular dominance would have an apparent division of fixation disparity such that most would be of the non-dominant eye. Only those with no ocular dominance would have fixation disparity apparently equally divided between the two eyes. This would be true, however, only if the dominant eye is the master eye in the fusion of the two subjective primary visual directions into the composite binocular direction.

The author wishes to stress that the following experiment should not be interpreted as measuring the true uniocular components of fixa-

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This article is an abridgement of part of the dissertation, *"Studies of Visual Fixation Disparity"* submitted in partial satisfaction of the requirements for the Ph.D. degree in the Graduate Division of the University of California, Berkeley, California, January, 1957.
†Optometrist, Ph.D., Member of the faculty; Fellow, American Academy of Optometry.

tion disparity. However, the total of the two apparent uniocular disparities will equal the real fixation disparity existing for the binocular portion of the target.

In a recent article, Bailey[1] concluded that the center of projection in a diplopia situation probably lies at or near the midsagittal plane between the two eyes. This result indicates that in normal binocular vision both eyes contribute equally to directionalization.

THE PROBLEM OF ADAPTATION

Two unforeseen problems became apparent as soon as the first data concerning the division of fixation disparity between the two eyes were obtained. One of these problems, that of a significant constant error in vernier alignment, has been discussed in a previous article.[3]

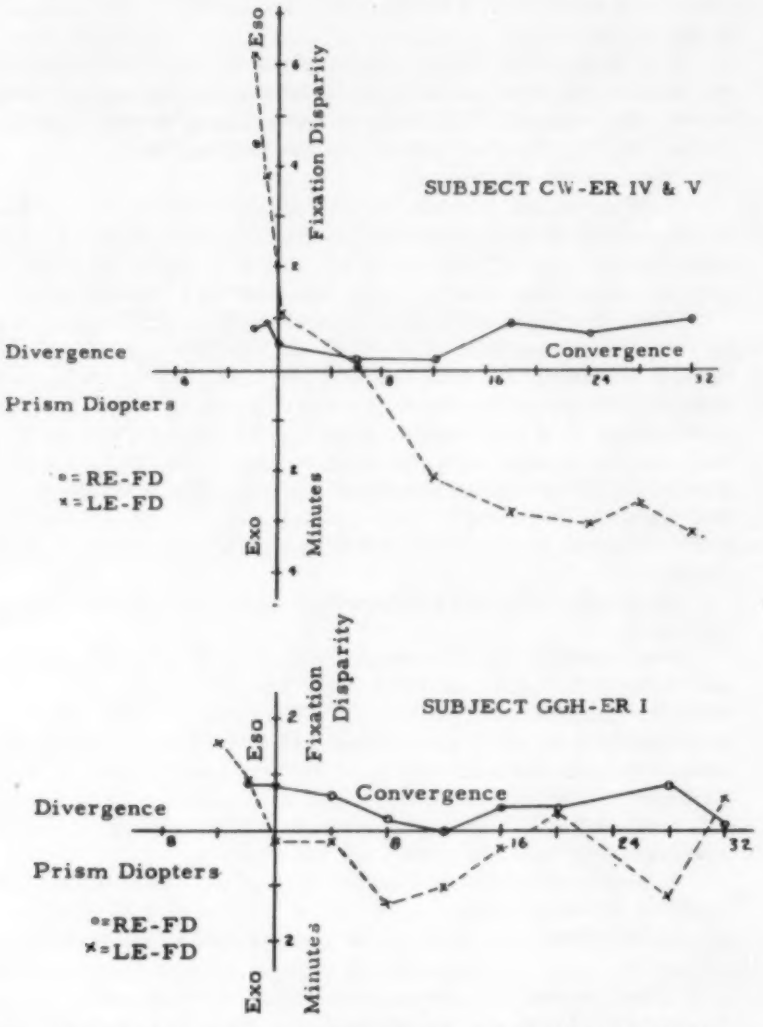
The adaptation phenomenon discovered by Ogle and Prangen[6] was sometimes very pronounced, so that three settings taken one after another through the same prism value would show a reduction of the fixation disparity even during the period of about two minutes required to take three settings. If at each vergence position the settings for the two eyes were made in the same order, for example, always the right eye setting then the left eye setting, the adaptation phenomenon would cause results that might be interpreted as demonstrating an undivided fixation disparity. The eye measured first would seemingly have all the fixation disparity.

Because this adaptation phenomenon exists, two procedures were adopted:

First, the uniocular components were taken without any adaptation to the prism value used. The prism was placed before the subject while the subject's eyes were closed. The subject opened his eyes, obtained fusion as soon as possible and then made one fixation disparity setting. Base-in and base-out prism were presented alternately until the limits of the range of motor fusion were reached. These settings will be referred to as "immediate" settings. All the settings for one eye were taken first, then the settings for the other eye.

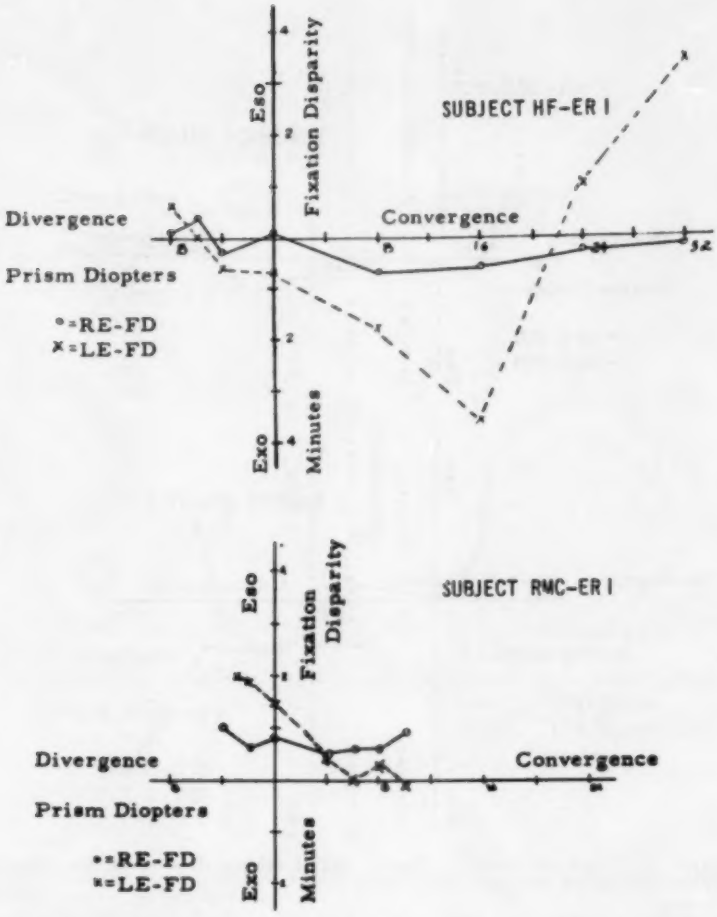
Second, several fixation disparity settings were made with a rest period of 15 minutes before each setting. This was done to attempt to discover whether this procedure of adapting back to no prism before each setting would yield significantly different fixation disparity values upon forced vergence than the procedure employed in taking the "immediate" data. There was no evidence that these two methods gave different results.*

*Complete data and graphs of the results of all experimental runs are included in the appendix of the dissertation. The reader is referred to the dissertation for a more



Figures 1a and 1b (Upper and Lower.) The uniocular components of fixation disparity of subjects showing most or all of their fixation disparity in one eye.

complete discussion of the experimental results of individual subjects as well as a more detailed development of some of the concepts put forth in this paper.



Figures 1c and 1d (Upper and Lower.) The uniocular components of fixation disparity of subjects showing most or all of their fixation disparity in one eye.

In addition to the above two procedures, prism adaptation settings were made by having the subject wear clip-on prisms over his spectacles or on an empty spectacle frame for an adaptation period, usually 15 minutes. These adaptation to prism experimental runs usually showed so little change in fixation disparity with different prism values that these runs offered little evidence concerning the division of fixation

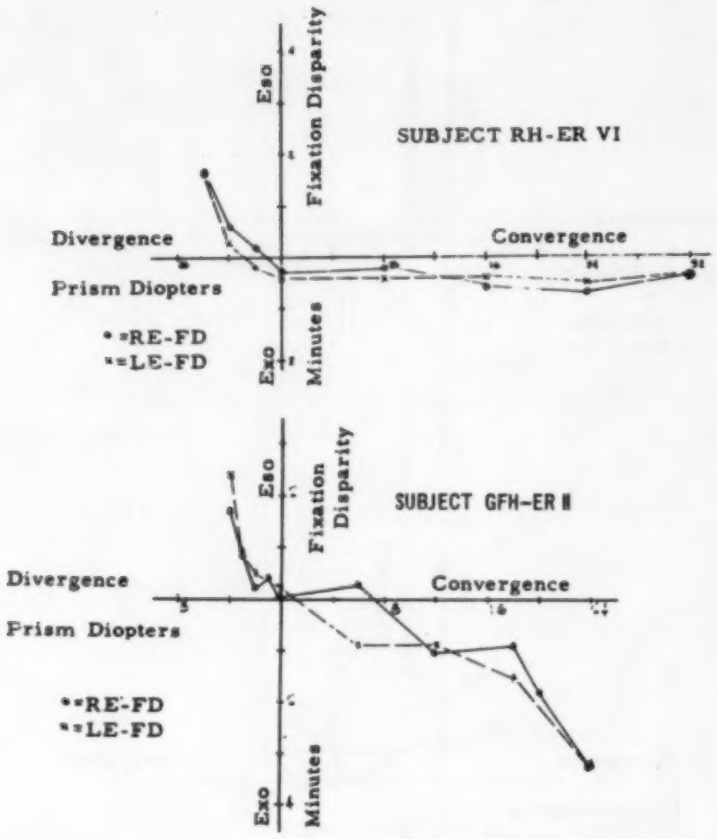


Figure 2a (Upper and Lower.) Typical data of subjects showing fixation disparity divided between the two eyes.

disparity between the two eyes. Therefore, the results of the prism adaptation technique are not considered in this paper but will be considered in a separate paper to be published.

The magnitude of the random error of the uniocular settings varied considerably among different subjects. The standard deviation of 10 settings made with rotary prisms set at zero varied from 0.10 minutes of arc to 0.82 minutes of arc, with a median value of 0.28 minutes of arc.

Where several experimental runs were made by the same subject there seemed to be a slight learning factor such that later settings scattered

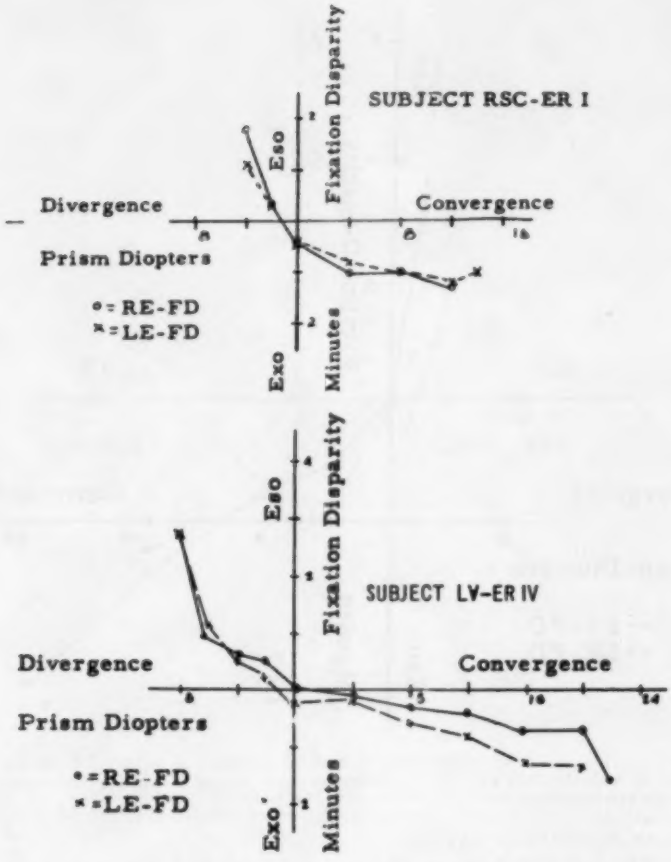


Figure 2b (Upper and Lower.) Typical data of subjects showing fixation disparity divided between the two eyes.

somewhat less. Subjects who had a high random error when making 10 fixation disparity settings at zero vergence stimulus would often be more precise during the prism vergence settings. Probably the subjects were motivated to make a more precise setting when they knew that only one setting was being taken at the particular prism stimulus. However, with some subjects the precision of settings at the extremes of the motor fusion range was affected by the conscious effort necessary for fusion.

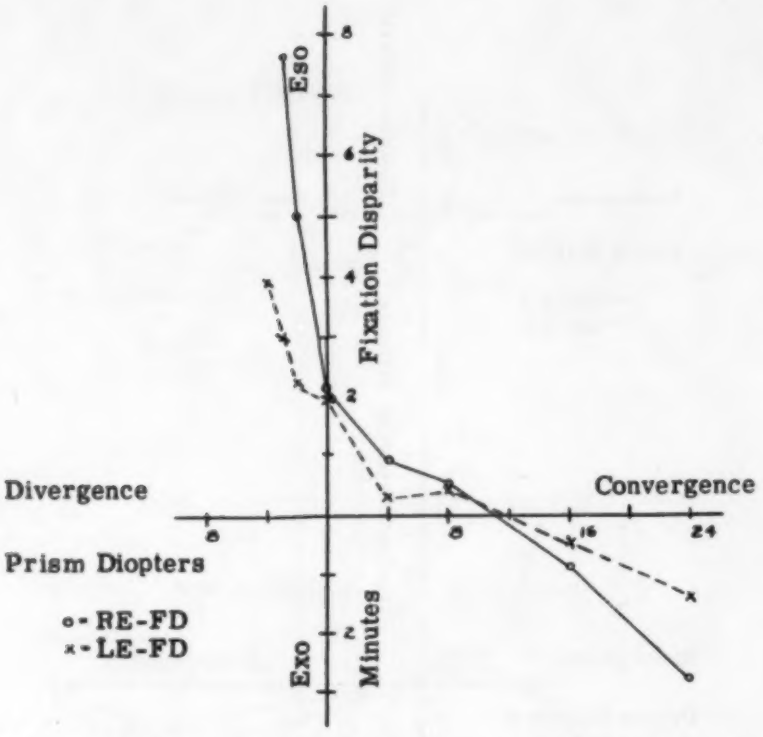


Figure 3. The uniocular components of fixation disparity of subject DB showing a change of both the right and left eye components but having a much greater change of the right eye component.

OCULAR DOMINANCE BATTERY

The ocular sighting dominance of 18 subjects was determined by the use of a battery of six tests, each administered twice. Four of the tests, the box, mirror, spot, and cone tests, were taken from Crider's Ocular Dominance Battery.[4] The other two tests were pencil alignment tests in which the subject, with both eyes open, held a pencil in one hand and pointed at a designated object. This was done with both the left and right hands holding the pencil.

SUBJECT GROUP

Data pertaining to the division of apparent fixation disparity between the two eyes were taken with 23 subjects. The subjects were nearly all students or faculty members at the University of California School of Optometry. A number had had considerable experience in

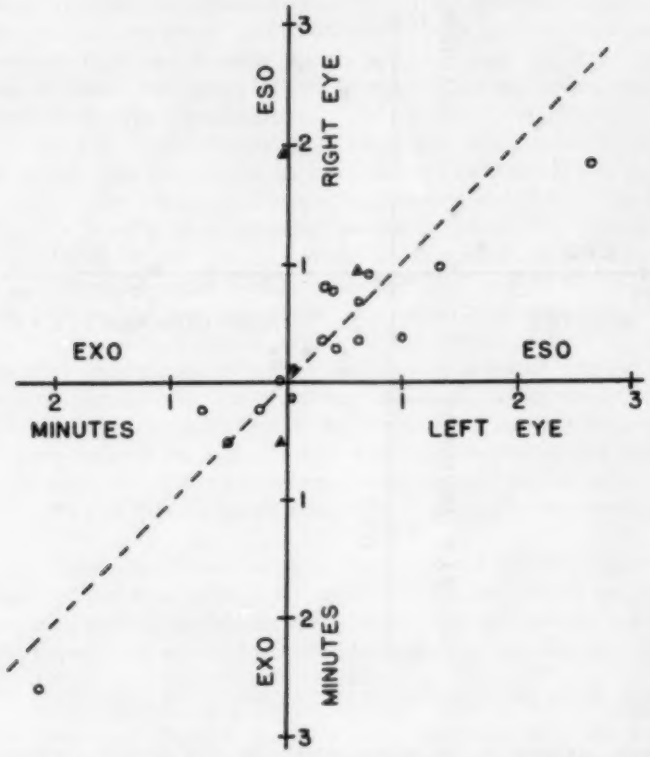


Figure 4. Scatter plot of the right and left eye components of fixation disparity. The diamonds represent subjects whose forced vergence curves indicated an undivided fixation disparity.

visual experimentation. Most, but not all, of the subjects had good binocular vision. The relation of any defect in binocular vision to the experimental results is discussed below.

RESULTS

The changes in the uniocular components of fixation disparity with forced vergence were determined with 22 subjects. Of these, only four subjects, RMC, HF, GGH, and CW, gave evidence of having their apparent fixation disparity mostly or entirely in one eye, in each case the non-dominant eye as determined by the ocular dominance battery. While the random error of the data made the interpretation of the results in some cases somewhat equivocal, with the other 18 subjects fixation

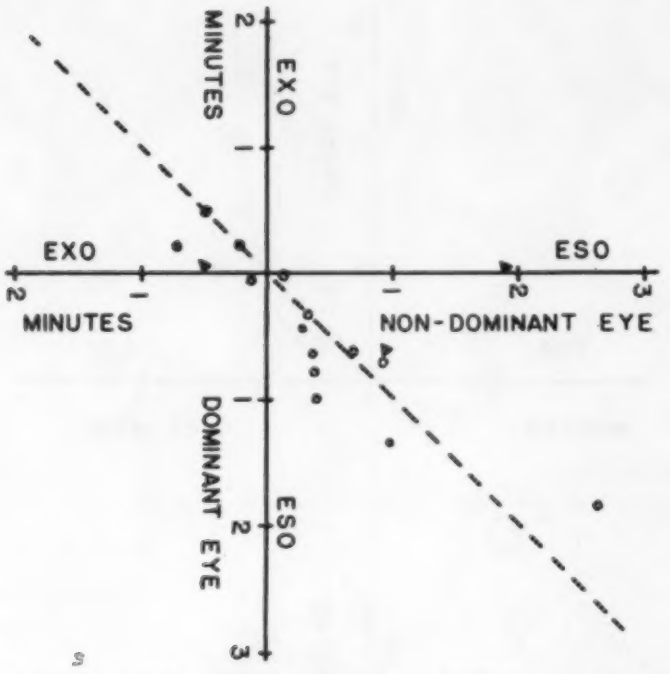


Figure 5. Scatter plot of the dominant and non-dominant eye components of fixation disparity.

disparity appeared to be approximately equally divided between the two eyes.

The time characteristics of the changes in fixation disparity upon wearing of prism were studied with subject JY, who was not one of the 22 subjects. Subject JY's data indicated that fixation disparity was divided between the two eyes.

Two of the four subjects who exhibited an apparently undivided fixation disparity have a history of poor binocular vision. Subject CW (Figure 1a), who had almost all of his fixation disparity exhibited by the left eye, had taken orthoptics the previous year in an attempt to eliminate a partial suppression of the left eye. He had refractive corrections of right eye —1.50 D.S. ⌒ —0.50 D.C. X 180, and left eye plano. With the lens, the right eye had a 20/20 Snellen visual acuity, while the left eye could not be improved above 20/25. His right eye was dominant on each of the tests of the ocular dominance battery.

While this subject exhibited nearly all of his fixation disparity in his left eye, his two sets of immediate curves both indicate some change in apparent right eye fixation disparity with forced vergence. His is a case in which the dominant eye is almost, but not quite, completely dominant in directionalization.

Subject GGH (Figure 1b), on whom unfortunately only one set of data was obtained, is an intermittent exotrope. When the tropia is evident, the left eye is always the deviating eye. All of his fixation disparity was likewise exhibited by the left eye. His right eye was dominant on each of the tests of the ocular dominance battery.

The experimental results of subjects HF and RMC (Figures 1c and 1d), while best interpreted as evidencing apparently undivided fixation disparity, were not completely conclusive. Subject HF showed relatively little change in fixation disparity upon forced vergence. However, the changes that did occur were apparently all in the left eye, the non-dominant eye as determined by the ocular dominance battery. The random error of the left eye data was considerably greater than that of the right eye. The two immediate experimental runs of subject RMC both indicated that almost all fixation disparity was in the non-dominant left eye.

Thus with all four subjects who exhibited an undivided fixation disparity, the fixation disparity apparently resided entirely or predominantly in the non-dominant eye as determined by sighting tests. The two subjects for whom the undivided nature of the fixation disparity was definite had binocular vision difficulties.

Seven subjects gave forced vergence curves which strongly indicated that their fixation disparity was divided between the two eyes (Figures 2a and 2b). These subjects showed a relatively small random scatter of the data and enough change in fixation disparity with forced vergence to allow the conclusion that the change was occurring in both eyes. Each of these subjects made at least two immediate experimental runs.

The curves for DB (Figure 3) are of interest for two reasons. He showed the greatest change in central fusion fixation disparity with forced vergence of any subject. While the fixation disparity was divided equally throughout most of the range of motor fusion, he showed a much greater right eye component than left eye component at the extreme base-in limit of the motor fusion range. This same result occurred with each of the five forced vergence experimental runs made by this subject. A possible explanation is that subject DB partially suppressed the right eye image of the top line while making base-in

settings of the apparent right eye component. This explanation is supported by the fact that subject DB occasionally suppresses his right eye.

Of the nine subjects not yet discussed, only one forced vergence run was made by four subjects, and thus no estimate of the reliability of the results can be made. While two or more immediate experimental runs were made by the other five subjects, the absence of any large change of central fusion fixation disparity and the presence of appreciable random scatter of the data made the interpretation of the apparent division of fixation disparity somewhat equivocal. However, the results of each of the nine subjects can best be interpreted as demonstrating fixation disparity divided between the two eyes.

A scatter plot of the left and right eye components of fixation disparity for 20 subjects is shown in Figure 4. Each circle represents the means of all settings taken with each subject at zero prism stimulus, the stimulus to convergence being that of the target. Only subjects who made at least three settings each of the right and left eye components are included, and, thus, three of the original 23 subjects are not plotted. All but three of the 20 subjects plotted made at least 20 settings.

The diamonds represent three subjects—RMC, GGH, and CW—whose forced vergence curves indicated an undivided fixation disparity. Because of the vernier constant error problem, an analysis of this plot is not as valuable as a study of forced vergence curves in estimating the incidence of divided and undivided fixation disparity. However, the plot clearly gives no support to the contention that fixation disparity nearly always resides in one eye.

Figure 5 shows a scatterplot of the uniocular components of fixation disparity at zero prism stimulus for the sighting dominant and non-dominant eyes. The diamonds again represent the subjects whose forced vergence curves indicated undivided fixation disparity. Of the three subjects represented in the scatter plot whose forced vergence curves indicated an undivided fixation disparity, two showed almost all of their fixation disparity at zero prism stimulus to be in the non-dominant eye. The other subject showed an approximately equal division of fixation disparity.

Of the 14 subjects included in Figure 5 whose forced vergence curves indicated fixation disparity divided between the two eyes, four subjects seemingly had their fixation disparity almost equally divided at zero prism stimulus, five showed more fixation disparity in the dominant eye and five showed more in the non-dominant eye.

CONCLUSIONS AND SUMMARY

The apparent division of fixation disparity between the two eyes

was determined for 23 subjects. It is concluded that persons with normal binocular vision subjectively show an equal division of fixation disparity. Those subjects whose experimental results definitely indicated an undivided fixation disparity were subjects who had a history of partial suppression of one eye.

The results of these experiments give no support to the belief that the sighting dominant eye is usually dominant in directionalization with persons with normal binocular vision and no history of partial suppression. With normal persons, a binocularly viewed object is directionalized by an averaging of the two directions that would have been perceived from the separate stimulation of each of the stimulated areas of the two retinas. From a subjective viewpoint, fixation disparity normally is equally divided between the two eyes.

Those persons who show a directionalization dominance of one eye as the result of a binocular sensory fusion defect do use the directionally dominant eye in tests designed to elicit the sighting dominant eye. However, a strong sighting dominance also occurs with subjects who use both eyes in directionalization. *Thus the cause of the phenomenon of sighting ocular dominance is not a dominance in directionalization.*

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ACADEMY POST-GRADUATE COURSES AT SAN FRANCISCO

A review of the 6th annual Academy post-graduate course series, scheduled for all optometrists at San Francisco, December 7, 8, 9, 1960 at the Sheraton-Palace Hotel is submitted on the following pages. This exceptional arrangement of 85 courses, each offered by an outstanding specialist in his subject, is the largest and we believe to be the finest example of post-graduate education ever placed before the profession. These courses are presented under the supervision of Dr. V. J. Ellerbrock of the Ohio State University and his committee. They have hand-picked their instructors from private practice and from our schools and colleges and in so doing are again presenting an array of talent entirely typical of Academy events. Every member of the profession is invited to take part. For most classes attendance is limited only by the size of the class rooms. Advanced registration is suggested.

CAREL C. KOCH

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

AMERICAN ACADEMY OF OPTOMETRY

POST-GRADUATE COURSES

Sheraton-Palace Hotel
San Francisco, California
December 7, 8, 9, 1960

GENERAL INFORMATION ON POST-GRADUATE COURSES

Time: All courses are scheduled for the three days immediately preceding the regular annual meeting of the Academy.

Place: All of the courses will be taught in the Sheraton-Palace Hotel.

Applicants: Any optometrist may apply for one or more courses. However, Academy Fellows have preference in advance registration until September 19, 1960.

Cancellation: In case of cancellation by applicant the fee will be returned, providing such cancellation is received no later than November 19, 1960.

Cost: The cost per hour of instruction is $2.00 unless otherwise specified.

Enrollment: For most courses the enrollment is not limited. Several specialized courses, however, are limited in enrollment as indicated in the description of courses.

Number of Courses: Eighty-five (85).

Hours of Instruction: One hundred and eighty-eight (188).

Applications: All applications should be sent to Dr. D. G. Hummel. The National City Bank Bldg., Cleveland, Ohio.

Deposit: One-half the total fee for each course must accompany the application. The balance must be paid at the commencement of the courses. Courses limited in enrollment must be accompanied by the full fee.

Tickets: Without exception, everyone enrolled in a course must register and pick up the appropriate ticket. Without it, no one can be admitted.

Lecture Rooms: These will be posted at the registration desk. The hotel bulletin board will state the location of the registration desk. Please check your time schedule of courses. The Committee cannot be responsible for conflicts of scheduling.

COMMITTEE ON INSTRUCTION
V. J. ELLERBROCK, Chairman
R. E. BANNON
M. C. FLOM

COMMITTEE ON ADMINISTRATION
D. G. HUMMEL, Chairman
R. EHRENBERG
M. H. KAUHL

Course 1
Home Visual Training
Louis Anapolle, O.D.

Boston, Mass.

A two-hour course—$4.00

Periods: W-2, W-3.

Basic training procedures to aid the busy practitioner in solving certain difficult cases. Prescription of self administered training techniques for heterophoria cases, accommodation-convergence problems, anisometropias, pseudo myopias, and early presbyopia.

Course 2
Rapid Reading for Adults
Louis Anapolle, O.D.

Boston, Mass.

A three-hour course—$12.00

(Enrollment Limited)

Periods: F-10, F-11, F-3.

A practical course to improve reading ability and to conduct a reading program for adults. The course will include demonstrations of tests, techniques, and training procedures to improve reading efficiency (perception training, speed reading, comprehension-retention and progress testing).

SCHEDULE OF COURSES BY HOURS

Hour	Wednesday	Thursday	Friday
8:00 A.M.	48 81 45 3 75	73 49 45 17 5	71 34 45 27 28
9:00 A.M.	48 21 29 3 75	37 49 50 17 20	71 38 82 28 8
10:00 A.M.	56 13 80 64 36	56 13 10 53 63	56 69 32 2 16 75
11:00 A.M.	56 13 80 64 36	56 13 10 84 63	56 69 23 2 16 75
12:00 Noon	66 12 70 19 46	74 12 47 8 15	6 12 41 58 55 7
1:00 P.M.	43 4 70 19 46	74 4 51 24 15	40 4 83 31 55 14
2:00 P.M.	61 57 9 1 72	61 39 9 54 65	61 60 9 52 25 22
3:00 P.M.	61 30 9 1 72	61 47 9 54 65	61 35 9 2 67 22
4:00 P.M.	56 13 85 59 18	56 13 11 84 26	56 40 79 28 78 33
5:00 P.M.	56 13 85 59 18	56 13 11 84 26	56 40 79 28 78 33
Evening	44 62 42 30 76	44 62 42 68 20	44 62 42 68 77
	44 62 42 30 76	44 62 42 68 20	44 62 42 68 77

Course 3
Accounting and Office Procedure
Otto J. Bebber, O.D.
Denver, Colorado
A two-hour course—$4.00
Periods: W-8, W-9.

Modern office accounting and credit methods for the professional office. Methods of evaluating services and costs-tax benefits.

Course 4
Eye Impressions and the Fitting of Haptic Contact Lenses
Solon M. Braff, O.D.
El Monte, California
And Associates
A three-hour course—$6.00
Periods: W-1, T-1, F-1.

Review of need based upon failures with corneal lenses: demonstration of moulding techniques, trial methods, successful lens constructions, and adjustment techniques.

Course 5
Special Clinical Problems in Ophthalmic Optics
James T. Crosby, Jr., O.D.
Hayward, California
A one-hour course—$2.00
Period: T-8.

Consideration of special clinical problems in ophthalmic optics related to the moving eye. Clinical factors in selection of base curves.

Course 6
Modern Plastic Lenses and Their Clinical Applications
Margaret Dowaliby, O.D.
Los Angeles, California
A one-hour course—$2.00
Period: F-12.

Modern-day plastic ophthalmic lenses are beneficial in many cases. The specific advantages of plastic over glass lenses will be fully discussed. Included will be the role of plastic lenses in absorptive prescriptions, multifocals and unusual lens considerations.

Course 7
Fee Planning in Ophthalmic Dispensing
Margaret Dowaliby, O.D.
Los Angeles, California
A one-hour course—$2.00
Period: F-11.

It has become obvious that the structure of professional fees must take account of certain new problems in ophthalmic dispensing. These problems will be discussed in the course and lead to the development of a fair realistic fee schedule for present day usage.

Course 8
Ophthalmic Dispensing and Mechanics
Robert S. Eakin, O.D.
Los Angeles, Calif.
A one-hour course—$2.00
Period: F-9.

Frame selection for anatomical and mechanical fit. Lens considerations. Mechanical principles, techniques and innovations involved in adjusting frames and lenses to achieve accurate positioning and comfort.

Course 9
Sub-normal Vision and Clinic
William Feinbloom, O.D., Ph.D.
New York, New York
Edward Williams, O.D.
Denver, Colorado
A six-hour course—$24.00
(Enrollment Limited)
Periods: W-2, W-3, T-2, T-3, F-2, F-3.

A combined lecture and clinic course designed to present and analyze problems of the partially blind patient. The application of visual aids in caring for these patients will be covered in detail.

KEY TO DESIGNATION OF PERIODS

Time	Wednesday	Thursday	Friday
8:00 A.M.	W-8	T-8	F-8
9:00	W-9	T-9	F-9
10:00	W-10	T-10	F-10
11:00	W-11	T-11	F-11
12:00	W-12	T-12	F-12
1:00 P.M.	W-1	T-1	F-1
2:00	W-2	T-2	F-2
3:00	W-3	T-3	F-3
4:00	W-4	T-4	F-4
5:00	W-5	T-5	F-5
6:00	W-6	T-6	F-6
7:00	W-7	T-7	F-7
8:00	W-E	T-E	F-E

Note: In program of Courses, (E) denotes 8:00 P.M. Evening Course.

Course 10
The Physiological Optics of the Partially Blind Eye
William Feinbloom, O.D., Ph.D.
New York, New York
A two-hour course—$4.00
Periods: T-10, T-11.

The effect of pathology and abnormalities on the physiological optics of the normal eye. The material presented in this course will enable the practitioner to screen, understand, and aid his partially blind patients.

Course 11
What Every Optometrist Should Know About Reading Disabilities
Bernice C. Flom, O.D.
Richmond, California
A two-hour course—$4.00
Periods: T-4, T-5.

The causes, detection, and treatment of reading problems in children. A practical discussion of the relationship between vision defects and reading disabilities, and the role of the optometrist in the overall management of reading disabilities. Case reports will be presented.

Course 12
Biomicroscopy
Edward Goodlaw, O.D.
Los Angeles, California
A three-hour course—$6.00
Periods: W-12, T-12, F-12.

A lecture course on the use of the slit lamp microscope in all phases of contact lens practice. Special attention will be given to pathology of the anterior segment of the eye.

Course 13
Advanced Course on Corneal Lenses
Robert Graham, O.D.
Pasadena, California
William Feinbloom, O.D., Ph.D.
New York, New York
And Associates
An eight-hour course—$32.00
(Enrollment Limited)
Periods: W-10, W-11, W-4, W-5, T-10, T-11, T-4, T-5.

Techniques for success in fitting modern corneal lenses: methods for securing optimum results in regular cases as well as procedures employed in handling the more difficult problems. The course is for those who already have substantial experience in the fitting of corneal contact lenses.

Course 14
Optometric Writing
James R. Gregg, O.D.
Los Angeles, Calif.
A one-hour course—$2.00
Period: F-1.

How to put a message across most effectively by the written word: 1.) In writing for scientific publications, and 2.) In writing for the general public and popular magazines.

Course 15
Effective Public Relations for an Optometric Office
James R. Gregg, O.D.
Los Angeles, Calif.
A two-hour course—$4.00
Periods: T-12, T-1.

A round-up of ideas to build public relations, not only for the office, but for the profession as well.

Course 16
Early Detection of Ocular Pathology
Theodore Grosvenor, O.D., Ph.D.
Houston, Texas
A two-hour course—$4.00

Periods: F-10, F-11.

A presentation of the subjective symptoms and clinical findings which can be utilized in the early detection of ocular pathology, together with the presentation of appropriate slides.

Course 17
Gonioscopy in Optometric Practice
Theodore Grosvenor, O.D., Ph.D.
Houston, Texas

A two-hour course—$4.00

Periods: T-8, T-9.

A presentation of the role of gonioscopy in the detection and differential diagnosis of acute congestive glaucoma; laboratory instruction in the use of the gonioscope.

Course 18
Ocular Manifestations of Systemic Diseases
Theodore Grosvenor, O.D., Ph.D.
Houston, Texas

A two-hour course—$4.00

Periods: W-4, W-5.

Presentation of the effects of systemic diseases upon the eye, their effects upon innervation and motility, and their indirect effects upon vision. Special attention will be given to the role of childhood diseases.

Course 19
The Development of Municipal Optometric Institutions
Alden N. Haffner, O.D.
Optometric Center of New York
New York, New York

A two-hour course—$4.00

Periods: W-12, W-1.

An examination of the needs, purposes and objectives of an out-patient, non-profit optometric institution. The discussion will review the activities of the Optometric Center of New York with special attention given to the indigent visual care program, referral center, post-graduate teaching and research center, and the program with the Department of Health.

Course 20
Recent Developments in the Neurophysiology of Vision
Duco Hamasaki, O.D.
Berkeley, California
Niles Roth, O.D.
Los Angeles, California
Richard Hill, O.D.
Berkeley, California

A three-hour course—$6.00

Periods: T-9, T-E.

The lectures will be devoted to: (1) discussion and demonstration of electrophysiological techniques used in the study of the visual system, (2) recent neurophysiological experiments which have important bearing on color vision, and (3) objective methods of measuring accommodation with implications on the basic mechanism of accommodation.

Course 21
Subjective Refraction
Robert F. Harrigan, O.D.
Berkeley, California

Period: W-9.

A one-hour course—$2.00

Subjective testing techniques, with particular emphasis on improved techniques for determining the power and axis of astigmatic errors.

Course 22
Night Vision
Gordon G. Heath, O.D., Ph.D.
Bloomington, Indiana

A two-hour course—$4.00

Periods: F-2, F-3.

Review and summary of recent research on vision in low illumination, including studies of night myopia, dark adaptation, scotopic visibility, acuity, color recognition, visual field changes, and glare, dazzle, and contrast problems in night driving.

Course 23
Stigmatoscopy
Gordon G. Heath, O.D., Ph.D.
Bloomington, Indiana

A one-hour course—$2.00

Period: F-11.

The stigmatoscope as an optical instrument. Its use in measurement of spherical correction, astigmatism, binocular balance, heterophoria, accommodative amplitude, and determination of presbyopic adds. Comparison of stigmatoscopic and conventional findings.

Course 24
The Badal Optometer
Gordon G. Heath, O.D., Ph.D.
Bloomington, Indiana

A one-hour course—$2.00

Period: T-1.

Demonstration of the use of the Badal optometer: its principles and construction: its advantages and disadvantages for specific purposes. Techniques for verification of subjective refraction, measurement of amplitude of accommodation, and application to visual training.

Course 25
Visual Fields with Multi-pattern Test Targets

Fred W. Hebbard, O.D., Ph.D.
Columbus, Ohio
A one-hour course—$2.00
Period: F-2.

Discussion and demonstration of multiple-pattern visual field screening techniques using tachistoscopic presentation of targets. Consideration of the advantages and limitations of such techniques, particularly with regard to detection of glaucoma.

Course 26
Recent Developments in Clinical Optometric Research
Fred W. Hebbard, O.D., Ph.D.
Columbus, Ohio
A two-hour course—$4.00
Periods: T-4, T-5.

Discussion of selected recent clinical research in optometry, including instruments, techniques, and interpretation of tests, as well as the implications of basic research findings as to future methods of optometric practice.

Course 27
Flicker Fusion: Principles and Applications
F. W. Hebbard, O.D., Ph.D.
Columbus, Ohio
A one-hour course—$2.00
Period: F-8.

Discussion of flicker perimetry, especially as an aid to early detection of glaucoma, with an introduction of a new form of flicker-fusion apparatus valuable in clinical practice.

Course 28
Statistical Methods for Optometrists
Monroe J. Hirsch, O.D., Ph.D.
Ojai, California
Frank W. Weymouth, O.D., Ph.D.
Los Angeles, California
A four-hour course—$8.00
Periods: F-8, F-9, F-4, F-5.

Not a typical statistics course. The new "non-parametric statistical methods" will be stressed. This form of statistics, sometimes termed "methods for a statistician in a hurry" has applicability to optometric data. The student will learn to test his own data by these methods.

Course 29
Refractive Changes Throughout Life
Monroe J. Hirsch, O.D., Ph.D.
Ojai, California
A one-hour course—$2.00
Period: W-9.

Data on the expected refractive changes with age will be presented with special emphasis on the value of these data in clinical practice.

Course 30
Vision of the Aging Patient
Monroe J. Hirsch, O.D., Ph.D.
Ojai, California
Ralph E. Wick, O.D.
Rapid City, South Dakota
A three-hour course—$6.00
Periods: W-3, W-E.

The lecturers are co-editors of the new text on *Vision of the Aging Patient*. The course will be based upon the text and will be a review of the contributions of the fifteen authorities who authored it.

Course 31
Measurement of Phoria and Fusion Range
Henry W. Hofstetter, O.D., Ph.D.
Bloomington, Indiana
A one-hour course—$2.00
Period: F-1.

Techniques of phoria measurement and the determination of the limits of fusion: sources of error and their control: criteria of validity and reliability.

Course 32
Binocular Nearpoint Testing Technique
Louis Jaques, O.D.
Los Angeles, California
A one-hour course—$2.00
Period: F-10.

A new technique for testing the refractive correction of each eye separately at the near point under conditions of binocular vision. The design of a system to implement the test will be described and the significance of the measurements discussed.

Course 33
Patient Counseling
Louis Jaques, O.D.
Los Angeles, California
A two-hour course—$4.00
Periods: F-4, F-5.

How to direct attention to, gain interest in and create a desire for the value of the professional work being administered. How to meet the needs and gain valuable recognition and professional acceptance.

Course 34
Microbiology in Contact Lens Practice
Harry A. Jankiewicz, O.D., Ph.D.
Los Angeles, California
A one-hour course—$2.00
Period: F-8.

The important viruses, bacteria and protozoa

affecting the conjunctiva and cornea. The contamination of fluids used in contact lens practice.

Course 35
Recent Advances in the Anatomy of the Cornea
Harry A. Jankiewicz, O.D., Ph.D.
Los Angeles, California
A one-hour course—$2.00
Period: F-3.

Histological studies on the layers of the cornea and the corneo-scleral and corneo-conjunctival junctions. The receptors and nerves in the cornea and conjunctiva.

Course 36
Writing of Optometric Papers
Carel C. Koch, O.D.
Minneapolis, Minnesota
Monroe J. Hirsch, O.D., Ph.D.
Ojai, California
A two-hour course—$4.00
Periods: W-10, W-11.

This course by the editor and associate editor of the *Am. J. Optom. and Arch. Amer. Acad. Optom.* is a review of the fundamentals of scientific writing. It is designed for the practicing optometrist who wishes to express himself in print but requires information about style, form, etc.

Course 37
Vertical Heterophorias
J. Donald Kratz, O.D.
Souderton, Pa.
A one-hour course—$2.00
Period: T-9.

A discussion of vertical heterophoria with emphasis on the differentiation of the concomitant and noncomitant types. A careful analysis of the methods of handling the progressive and stationary noncomitant types will be presented.

Course 38
Diagnosis of Amblyopia vs. Central Scotomata
J. Donald Kratz, O.D.
Souderton, Pa.
A one-hour course—$2.00
Period: F-9.

Various techniques to differentiate amblyopia, suppression and central scotomas. The prognosis for the various types of central field loss associated with strabismus and amblyopia will be discussed.

Course 39
Biochemical Aspects of Contact Lens Fitting
Joseph Z. Krezanoski, Ph.D.
Sunnyvale, California
(By Invitation)
A one-hour course—$2.00
Period: T-2.

The structure, composition and metabilism of corneal and adjacent tissue structures will be reviewed. Particular attention will be given to the affect of lenses on contact with the eye and its appendages.

Course 40
Fast, Gentle and Exact Automatic Electronic Tonometry
Elwin Marg, O.D., Ph.D.
Berkeley, California
A three-hour course—$6.00
(Enrollment Limited)
Periods: F-1, F-4, F-5.

Theory and practice of the new tonometer and its role in the detection of glaucoma. This is a combined lecture and laboratory course.

Course 41
Contact Lenses and the Shirmer Test
Marshall V. Mark, O.D.
Boston, Massachusetts
A one-hour course—$2.00
Period: F-12.

A presentation of the Shirmer Test for measuring the amount of tears in the cul-de-sac. The importance of conducting this test in the interest of the successful contact lens case will be discussed.

Course 42
Recent Advances in Ocular Motility
Marshall V. Mark, O.D.
Boston, Massachusetts
A six-hour course—$12.00
Periods: W-E, T-E, F-E.

Illustrated lectures and demonstrations of the latest diagnostic and therapeutic techniques concerned with the extraocular muscles. The subject matter has important practical application and is based on clinical experiments. The most important aspects of the physiology and the pathologic physiology of the extrinsic muscles will be included. The step-by-step procedures of diagnosis will be discussed in detail.

Course 43
The Pupilens
Bernard Mazow, O.D.
Houston, Texas
A one-hour course—$2.00
Period: W-1.

Theory and demonstration of limited aperture contact lenses for the correction of presbyopia and sub-normal vision.

Course 44
Slit Lamp Microscopy in Contact Lens Practice
Bernard Mazow, O.D.
Houston, Texas
A six-hour course—$24.00
(Enrollment Limited)
Periods: W-E, T-E, F-E.

Lecture and laboratory course in biomicroscopy with emphasis on the mechanics and use of the instrument. Special attention will be given to the use of the slit lamp in contact lens fitting.

Course 45
Summary of Bangerter Technique for Training Amblyopia
Meredith W. Morgan, O.D., Ph.D.
Berkeley, California
A three-hour course—$6.00
Periods: W-8, T-8, F-8.

Summary of methods used by Bangerter in training amblyopic subjects. Certain modifications will be suggested to make the method applicable in the average office using inexpensive equipment. A brief discussion of eccentric fixation will be given.

Course 46
Ophthalmic Prisms
Meredith W. Morgan, O.D., Ph.D.
Berkeley, California
A two-hour course—$4.00
Periods: W-12, W-1.

Brief discussion of the distortions created by ophthalmic prisms. Various useful methods for the prescribing of prisms will be presented.

Course 47
Turville Infinity Balance Test
Meredith W. Morgan, O.D., Ph.D.
Berkeley, California
A two-hour course—$4.00
Periods: T-12, T-3.

The Turville infinity binocular balance technique for determining the subjective refractive error of each eye while maintaining single binocular vision will be demonstrated. The utilization of the method, frequently referred to as the TIB technique, will be discussed. The prescribing of base-in and vertical prisms will be described.

Course 48
Astigmatism and Contact Lenses
Harold I. Moss, O.D.
Wilmington, Delaware
A two-hour course—$4.00
Periods: W-8, W-9.

Irregular, residual and induced astigmatism as it applies to contact lens practice. The application of corneal and haptic lenses in correction.

Course 49
Corneal Contours in Contact Lens Practice
Harold I. Moss, O.D.
Wilmington, Delaware
A two-hour course—$4.00
Periods: T-8, T-9.

Recent data on corneal contours; particular attention will be given to the role of this data in the design of the base and peripheral curves of a corneal lens. The significance and causes of corneal exhaustion also will be included.

Course 50
Cosmetic Contact Lenses
Herbert L. Moss, O.D.
Woodbridge, New Jersey
A one-hour course—$2.00
Period: T-9.

The design and fitting of ventilated haptic lenses for obscuration of ocular disfigurement including a demonstration of injection moulding technique.

Course 51
Contact Lens Records, Forms and Routine
Herbert L. Moss, O.D.
Woodbridge, New Jersey
A one-hour course—$2.00
Period: T-1.

An efficient routine in the design and fitting of contact lenses will be discussed and recommended record forms to implement the routine will be presented.

Course 52
House Calls and Visual Care of the Invalid Patient
Thaddeus R. Murroughs, O.D.
Santa Barbara, California
A one-hour course—$2.00
Period: F-2.

The course covers the optometric examinations of the invalid. A check list of minimum equipment is provided. Special refracting considerations are evaluated with respect to the degree and type of infirmity. Various methods of prescribing corrections are related to the type of illness, degree of acuity and degree of immobility.

Course 53
Therapeutic Procedures in Aphakic Patients
Thaddeus R. Murroughs, O.D.
Santa Barbara, California

A one-hour course—$2.00
Period: T-10.

The spatial problems of aphakic patients are described from the standpoint of magnification and role of vertex distance. The refractive and dispensing routine and after-care are discussed with respect to instrumentation, lens tilt, center thickness, base curves and consideration in the selection of the prescribed lens.

Course 54
Unfavorable Prognostic Pointers in the Treatment of Strabismus
Thaddeus R. Murroughs, O.D.
Santa Barbara, California
A two-hour course—$4.00
Periods: T-2, T-3.

Features adverse to strabismus therapy are presented. A method of identifying and evaluating each of these conditions is presented. The aim is to furnish a method for screening out those cases that are unfavorable orthoptic risks.

Course 55
Social Evaluation of Trends in Optometry
Melvin Nadell, O.D. Ph.D.
Los Angeles, California
A two-hour course—$4.00
Periods: F-12, F-1.

Relationships between optometry and the general public, optometry and the other healing arts, groups within optometry, socio-economic status of optometrists, and trends in the location of optometric practices.

Course 56
Technique of Microlens Fitting
John C. Neill, O.D.
Philadelphia, Pa.
And Associates
A twelve-hour course—$48.00
(Enrollment Limited)
Periods: W-10, W-11, W-4, W-5, T-10, T-11, T-4, T-5, F-10, F-11, F-4, F-5.

Lectures and practical work in the clinical fitting of patients with microlenses.

Course 57
Aniseikonia and the Use of Contact Lenses
Henry B. Peters, O.D.
Oakland, California
A one-hour course—$2.00
Period: W-2.

The use of contact lenses in the care of aniseikonia; methods of differential diagnosis and prediction of success.

Course 58
How to Become a Vision Consultant to Industry
Henry B. Peters, O.D.
Oakland, California
A one-hour course—$2.00
Period: F-12.

Specific information regarding a new method of promoting the use of industrial vision consultants by utilizing the sales and promotion activities of safety supply companies.

Course 59
Vision Screening for Elementary School Children
Henry B. Peters, O.D.
Oakland, California
A two-hour course—$4.00
(Enrollment Limited)
Periods: W-4, W-5.

Explanation and demonstration of a modified clinical technique with children serving as subjects.

Course 60
Bifocal Contact Lenses
Chester H. Pheiffer, O.D., Ph.D.
Houston, Texas
A one-hour course—$2.00
Period: F-2.

Types available, problems and difficulties in fitting, determination of lens characteristics, and criteria of good fit will be discussed.

Course 61
Adjustment and Modification of Contact Lenses
William Policoff, O.D.
Wilkes-Barre, Pa.
And Associates
A six-hour course—$24.00
(Enrollment Limited)
Periods: W-2, W-3, T-2, T-3, F-2, F-3.

A laboratory course covering the following subjects: Changing diameter of lenses, refinishing edge of lens, reducing optical zone, changing radius of peripheral radius on concave side of lens, reducing edge thickness of lens, removing fine surface scratches from convex and concave surface of lens, changing small amounts of power in the lens, conlish edge finishing, grinding toric bevels, drilling and grinding apertures in contact lenses.

Course 62
Subnormal Vision

Alfred A. Rosenbloom, Jr., O.D.
Chicago, Illinois
William Policoff, O.D.
Wilkes-Barre, Pa.
A six-hour course—$24.00
Periods: W-E, T-E, F-E.

All aspects of the problem are considered, including definition, causes, psychological factors, patient selection, examination techniques, considerations in selecting the appropriate visual aid, and adaptive training procedures. Both the problems of the education and of the rehabilitation of the partially blind person will be considered. The course will include a clinical demonstration of examination techniques.

Course 63
Visual Development in the Pre-School Child
Alfred A. Rosenbloom, Jr., O.D.
Chicago, Illinois
A two-hour course—$4.00
Periods: T-10, T-11.

This course will consider the inter-relatedness of such factors as physical, mental, social, and linguistic growth. The pertinence of these in promoting visual readiness for learning will be particularly stressed.

Course 64
Visual Screening Procedures
Alfred A. Rosenbloom, Jr., O.D.
Chicago, Illinois
A two-hour course—$4.00
Periods: W-10, W-11.

Purposes of visual screening, characteristics evaluated by visual screening tests, currently available screening instruments, criteria and interpretation of findings for referral are considered. The implications and significance of the screening procedures as they relate to discussion with parents, school nurse, and educators will be reviewed.

Course 65
Prolonged Occlusion Testing
Raymond R. Roy, O.D.
Portland, Oregon
A two-hour course—$4.00
Periods: T-2, T-3.

An advanced course for those who have done prolonged occlusion testing, discussion of case histories and problems with time for questions.

Course 66
Procedures for Contact Lens Fitting
Morton D. Sarver, O.D.
Berkeley, California
A one-hour course—$2.00
Period: W-12.

Discussion and description of methods employed in recording patients' visits, observations, instructions given, recall and patient, control, and data on lens specification and modifications.

Course 67
Stereopsis
Max Schapero, O.D.
Los Angeles, California
A one-hour course—$2.00
Period: F-3.

Theoretical and clinical considerations of stereopsis, development, role in depth perception, methods of testing especially with a stereoscope, and visual training procedures for improvement.

Course 68
Ocular Pathology Review Organized by the Section on Pathology
Arthur Shlaifer, O.D., Ph.D., Chairman
Philadelphia, Pa.
A four-hour course—$8.00
Periods: T-E, F-E.

An illustrated review of ocular pathology of primary importance to the optometrist from the standpoint of incidence and significance.

Course 69
Ocular Emergencies
Harold Simmerman, O.D.
Wenonah, N. J.
A two-hour course—$4.00
Periods: F-10, F-11.

Illustrated lecture on the ocular diseases seen by optometrists and a description of their classification as 'emergent' or 'urgent' in getting the patient under medical management.

Course 70
Hypertensive and Arteriosclerotic Retinopathies
Harold Simmerman, O.D.
Wenonah, N. J.
A two-hour course—$4.00
Periods: W-12, W-1.

Retinal geratrics: illustrated lecture on the changes in the retina and choroid due to hypertension and arteriosclerosis and the attending sequalae. Also the grading of the retinal changes.

Course 71
Evolution of Corneal Lenses
Charles R. Stewart, O.D., Ph.D.
Houston, Texas
A two-hour course—$4.00
Periods: F-8, F-9.

Using the corneal "contour" concept described by Bier, evolution of the design and fitting characteristics of six types of corneal lenses is described. This comparison enables one to utilize

the fitting variables of today's lenses more advantageously in prescribing for contact lens patients.

Course 72
Space Eikonometer Technique of Measuring Aniseikonia
Donald A. Springer, O.D.

Anniston, Alabama

A two-hour course—$4.00

Periods: W-2, W-3.

This course will be devoted to the step-by-step procedure of measuring aniseikonia with the Space Eikonometer. The presentation will include not only the technique for usual patients, but also for more complicated cases which have difficulty in making reliable responses. The subject material will be essentially practical and based upon actual clinical experience. Specific questions germane to the technique of measuring aniseikonia will be discussed during the course.

Course 73
Elements in Effective Optometric Legislation
Roy M. Swain, O.D.

Ukiah, California

A one-hour course—$2.00

Period: T-8.

Basic individual and organizational procedures necessary in county, state, and national legislative functions.

Course 74
Contact Lens Solutions—Their Rationale and Use
Ivan J. Szekely, Ph.D.

Sunnyvale, California

(By Invitation)

A two-hour course—$4.00

Periods: T-12, T-1.

The use of contact lens solutions (wetting agents, hydrating solutions, decongestants and diagnostic aids) will be discussed. Physical-chemical aspects of formulation of these solutions as it relates to the physiology of the eye will be presented with particular emphasis on the hygienic care of contact lenses. Illustrative demonstrations will be provided.

Course 75
Use of New Plastics in Fitting Spectacle Frames and Inspecting Contact Lenses
Akira Tajiri, O.D.

Reedley, California

A two-hour course—$4.00

Periods: F-10, F-11.

Discussion and demonstration of the use of molding plastic in the custom fitting of bridges and temples of spectacle frames. Also a demonstration of a related technique for the accurate inspection of contours and edges of contact lenses.

Course 76
Genetic Problems Encountered in Optometric Practice
Gordon L. Walls, Sc.D.

Berkeley, California

A two-hour course—$4.00

Periods: W-E.

Hereditary anomalies of the eye most likely to be seen by optometrists, and the elements of genetic counselling.

Course 77
Embryology of the Human Eye
Gordon L. Walls, Sc.D.

Berkeley, California

A two-hour course—$4.00

Periods: F-E.

Embryonic development of the human eye and its connections to cerebral visual centers.

Course 78
Accommodation and Refractive Errors
Gerald Westheimer, O.D., Ph.D.

Columbus, Ohio

A two-hour course—$4.00

Periods: F-4, F-5.

New methods of measuring the refractive state of the eye will be discussed, including some automatic ones. Recent findings have some interesting implications in connection with the adjustment of the accommodative state of the eye and with the refractive error.

Course 79
Visual Acuity
Frank W. Weymouth, Ph.D.

Los Angeles, California

A two-hour course—$4.00

Periods: F-4, F-5.

A discussion of the fundamental factors, both of the stimulus and of the state of the eye, and their relation to various types of acuity tests. The relation of acuity to age. The efficient use of some important interrelations in acuities will be considered.

Course 80
Surgery in Strabismus
R. H. Whitten, M.D.

Fresno, California

(By Invitation)

A two-hour course—$4.00

Periods: W-10, W-11.

The role of surgery in the treatment of

strabismus, with emphasis on its coordination with other methods of treatment.

Course 81
Patient Referrals
R. H. Whitten, M.D.
Fresno, California
(By Invitation)
A one-hour course—$2.00
Period: W-8.

How, when and why to refer patients for consultation.

Course 82
The Effect of Contact Lenses on Corneal Physiology
Bradford W. Wild, O.D., Ph.D.
Columbus, Ohio
A one-hour course—$2.00
Period: F-9.

The physiology of the normal cornea and the influence of contact lenses upon corneal function. Consideration will be given to corneal sensitivity and the development of haze and halo (Sattler's Veil).

Course 83
Quality Control of Contact Lenses
Bradford W. Wild, O.D., Ph.D.
Columbus, Ohio
A one-hour course—$2.00
Period: F-1.

A review of the basic variables in contact lens manufacture and a description of methods used to measure and/or evaluate these variables. Demonstrations of these techniques will be made.

Course 84
Basic Techniques for the Diagnosis and Evaluation of Strabismus
Bradford W. Wild, O.D., Ph.D.
Columbus, Ohio
A three-hour course—$6.00
Periods: T-11, T-4, T-5.

Methods of detecting and measuring strabismus. Consideration also will be given to the diagnosis of central scotomata, eccentric fixation and anomalous correspondence. Demonstrations of these methods will be given.

Course 85
Orthoptics
John Zettel, Jr., O.D.
Cincinnati, Ohio
A two-hour course—$4.00
Periods: W-4, W-5.

Beginning an orthoptics practice; application of orthoptics; role of advanced orthoptics techniques such as pleoptics.

CONDENSED SCHEDULE OF COURSES

Course	Instructor	Subject	Hours	Periods
1	Anapolle	Home Visual Training, $4.00	2	W-2, W-3
2	Anapolle	Rapid Reading for Adults, $12.00	3	F-10, F-11, F-3
3	Bebber	Accounting & Office Procedure, $4.00	2	W-8, W-9
4	Braff	Eye Impressions & the Fitting of Haptic Contact Lenses, $6.00	3	W-1, T-1, F-1
5	Crosby	Special Clinical Problems in Ophthalmic Optics, $2.00	1	T-8
6	Dowaliby	Modern Plastic Lenses & Their Clinical Applications, $2.00	1	F-12
7	Dowaliby	Fee Planning in Ophthalmic Dispensing, $2	1	F-9
8	Eakin	Ophthalmic Dispensing & Mechanics, $2.00	1	F-9
9	Feinbloom & Williams	Sub-normal Vision & Clinic, $24.00	6	W-2, W-3, T-2, T-3, F-2, F-3
10	Feinbloom	The Physiological Optics of the Partially Blind Eye, $4.00	2	T-10, T-11
11	Flom	What Every Optometrist Should Know About Reading Disabilities, $4.00	2	T-4, T-5,
12	Goodlaw	Biomicroscopy, $6.00	3	W-12, T-12, F-12
13	Graham & Feinbloom	Advanced Course on Corneal Lenses, $32.00	8	W-10, W-11, W-4, W-5, T-10, T-11, T-4, T-5
14	Gregg	Optometric Writing, $2.00	1	F-1

CONDENSED SCHEDULE OF COURSES

Course	Instructor	Subject	Hours	Periods
15	Gregg	Effective Public Relations for an Optometric Office, $4.00	2	T-12, T-1
16	Grosvenor	Early Detection of Ocular Pathology, $4.00	2	F-10, F-11
17	Grosvenor	Gonioscopy in Optometric Practice, $4.00	2	T-8, T-9
18	Grosvenor	Ocular Manifestations of Systemic Diseases, $4.00	2	W-4, W-5
19	Haffner	The Development of Municipal Optometric Institutions, $4.00	2	W-12, W-1
20	Hamasaki, Roth & Hill	Recent Developments in the Neurophysiology of Vision, $6.00	3	T-9, T-E
21	Harrigan	Subjective Refraction, $2.00	1	W-9
22	Heath	Night Vision, $4.00	2	F-2, F-3
23	Heath	Stigmatoscopy, $2.00	1	F-11
24	Heath	The Badel Optometer, $2.00	1	T-1
25	Hebbard	Visual Fields with Multi-pattern Test Targets, $2.00	1	F-2
26	Hebbard	Recent Developments in Clinical Optometric Research, $4.00	2	T-4, T-5
27	Hebbard	Flicker Fusion: Principles & Applications, $2	1	F-8
28	Hirsch & Weymouth	Statistical Methods for Optometrists, $8.00	4	F-8, F-9, F-4, F-5
29	Hirsch	Refractive Changes Throughout Life, $2.00	1	W-9
30	Hirsch & Wick	Vision of the Aging Patient, $6.00	3	W-3, W-E
31	Hofstetter	Measurement of Phoria & Fusion Range, $2	1	F-1
32	Jaques	Binocular Nearpoint Testing Technique, $2	1	F-10
33	Jaques	Patient Counseling, $4.00	2	F-4, F-5
34	Jankiewicz	Microbiology in Contact Lens Practice, $2.00	1	F-8
35	Jankiewicz	Recent Advances in the Anatomy of the Cornea, $2.00	1	F-3
36	Koch & Hirsch	Writing of Optometric Papers, $4.00	2	W-10, W-11
37	Kratz	Vertical Heterophorias, $2.00	1	T-9
38	Kratz	Diagnosis of Amblyopia vs. Central Scotomata, $2.00	1	F-9
39	Krezanoski	Biochemical Aspects of Contact Lens Fitting, $2.00	1	T-2
40	Marg	Fast, Gentle & Exact Automatic Electronic Tonometry, $6.00	3	F-1, F-4, F-5
41	Mark	Contact Lenses & the Shirmer Test, $2.00	1	F-12
42	Mark	Recent Advances in Ocular Motility, $12.00	6	W-E, T-E, F-E
43	Mazow	The Pupilens, $2.00	1	W-1
44	Mazow	Slip Lamp Microscopy in Contact Lens Practice, $24.00	6	W-E, T-E, F-E
45	Morgan	Summary of Bangerter Technique for Training Amblyopia, $6.00	3	W-8, T-8, F-8
46	Morgan	Ophthalmic Prisms, $4.00	2	W-12, W-1
47	Morgan	Turville Infinity Balance Test, $4.00	2	T-12, T-3
48	Moss	Astigmatism & Contact Lenses, $4.00	2	W-8, W-9
49	Moss	Corneal Contours in Contact Lens Practice, $4.00	2	T-8, T-9
50	Moss	Cosmetic Contact Lenses, $2.00	1	T-9
51	Moss	Contact Lens Records, Forms & Routine, $2	1	T-1
52	Murroughs	House Calls & Visual Care of the Invalid Patient, $2.00	1	F-2
53	Murroughs	Therapeutic Procedures in Aphakic Patients, $2.00	1	T-10

CONDENSED SCHEDULE OF COURSES

Course	*Instructor*	Subject	Hours	Periods
54	Murroughs	Unfavorable Prognostic Pointers in the Treatment of Strabismus, $4.00	12	W-10, W-11,
55	Nadell	Social Evaluation of Trends in Optometry, $4.00	2	T-2, T-3
56	Neill & Associates	Technique of Microlens Fitting, $48.00	2	F-12, F-1 W-4, W-5, T-10, T-11, T-4, T-5, F-10, F-11, F-4, F-5
57	Peters	Aniseikonia & the Use of Contact Lenses, $2	1	W-2
58	Peters	How to Become a Vision Consultant in Industry, $2.00	1	F-12
59	Peters	Vision Screening for Elementary School Children, $4.00	2	W-4, W-5
60	Pheiffer	Bifocal Contact Lenses, $2.00	1	F-2
61	Policoff & Associates	Adjustment & Modification of Contact Lenses, $24.00	6	W-2, W-3, T-2, T-3, F-2, F-3
62	Rosenbloom & Policoff	Subnormal Vision, $24.00	6	W-E, T-E, F-E
63	Rosenbloom	Visual Development in the Pre-School Child, $4.00	2	T-10, T-11
64	Rosenbloom	Visual Screening Procedures, $4.00	2	W-10, W-11
65	Roy	Prolonged Occlusion Testing, $4.00	2	T-2, T-3
66	Sarver	Procedures for Contact Lens Fitting, $2.00	1	W-12
67	Schapero	Stereopsis, $2.00	1	F-3
68	Shlaifer	Ocular Pathology Review Organized by the Section on Pathology, $8.00	4	T-E, F-E
69	Simmerman	Ocular Emergencies, $4.00	2	F-10, F-11
70	Simmerman	Hypertensive & Arteriosclerotic Retinopathies, $4.00	2	W-12, W-1
71	Stewart	Evolution of Corneal Lenses, $4.00	2	F-8, F-9
72	Springer	Space Eikonometer Technique of Measuring Aniseikonia, $4.00	2	W-2, W-3
73	Swain	Elements in Effective Optometric Legislation, $2.00	1	T-8
74	Szekely	Contact Lens Solutions—Their Rationale & Use, $4.00	2	T-12, T-1
75	Tajiri	Use of New Plastics in Fitting Spectacle Frames & Inspecting Contact Lenses, $4.00	2	F-9, F-10
76	Walls	Genetic Problems Encountered in Optometric Practice, $4.00	2	W-E
77	Walls	Embryology of the Human Eye, $4.00	2	F-E
78	Westheimer	Accommodation & Refractive Errors, $4.00	2	F-4, F-5
79	Weymouth	Visual Acuity, $4.00	2	F-4, F-5
80	Whitten	Surgery in Strabismus, $4.00	2	W-10, W-11
81	Whitten	Patient Referrals, $2.00	1	W-8
82	Wild	The Effect of Contact Lenses on Corneal Physiology, $2.00	1	F-9
83	Wild	Quality Control of Contact Lenses, $2.00	1	F-1
84	Wild	Basic Techniques for the Diagnosis & Evaluation of Strabismus, $6.00	3	T-11, T-4, T-5
85	Zettel	Orthoptics, $4.00	2	W-4, W-5

FOR ADVANCED REGISTRATION

AMERICAN ACADEMY OF OPTOMETRY

SAN FRANCISCO, DECEMBER 7, 8, 9, 1960
SHERATON-PALACE HOTEL

Applications should be made to Dr. D. G. Hummel, 1318 National City Bank Bldg., Cleveland 14, Ohio. One-half of the total fee for courses with non-limited attendance and *the entire fee for each course with limited attendance much accompany the application.* The balance must be paid at the commencement of courses. Without exception everyone enrolled in courses must register and pick up appropriate tickets for each course. Without them, no one can be admitted. Acceptance of applications will be on a first come first serve basis. When the number allowable in any course is filled, applications will be received on a contingent basis and used in case of cancellation. In case of cancellation the fee will be returned, providing such cancellation is received no later than November 19, 1960.

Advance Order Sheet

Please indicate courses you wish to take.

No. of Course	Instructor	Hours	Total Fee	Date	Time

Name_____

Address_____

City_____ State_____

For Use of the Committee on Administration

Deposit_____ Balance_____

Date Received_____

Notified_____ Date_____ Accepted_____ Contingent_____

CUT HERE AND MAIL

SPECIAL REPORT

CATARACTS AMONG OLDER PATIENTS

A patient with a visual anomaly has two needs. First, through lenses or other procedures the problem itself must be resolved. Second, and we believe of greater importance, the patient must understand his anomaly, its significance, its future importance, and the steps he must take to "live with it". The optometrist who fails to do this second service has only done half his job.

To meet this need for patient advice, numerous pamphlets and tracts have been produced, each designed to explain some aspect of vision to the patient. The optometrist, with a few words of introduction, presents the printed material to the patient and suggests that he read this at his leisure.

We believe that this is a very unsatisfactory procedure, primarily because it is rare to find a printed tract which will explain the problem exactly as the individual optometrist would. However, even were an optometrist to write the material himself, assuring moderate agreement between the printed word and his own beliefs, he should still find the method lacking since each patient is different.

To relegate the explanation of a patient's problem to a printed form is to completely invalidate the value of the discussion.

We believe that handing the patient a prepared statement which is designed to answer all of his questions is as satisfactory a solution to his need for advice as handing him a ready made pair of glazed goods is to his need for lenses.

The present paper is a discussion of one statement in one pamphlet. It is worthy of mention in its own light, but it also will serve to illustrate the shortcomings of printed explanations to patients.

The pamphlet we have chosen to discuss is well written and generally sound. It is entitled "Answers to your Questions on Cataracts," and it is published by the Division of Applied Visual Science of the Titmus Optical Company, Inc., of Petersburg, Virginia. The introduction and, we presume, the complete text is written by Morgan B. Raiford, M.D., D.Sc. (Med.) and Fred L. Vidal, M.D., Atlanta, Georgia. Copies are available free of charge to optometrists through distributors or by writing directly to the publishers. It is evidently being widely used by optometrists.

It should be stated at the outset that nothing in the criticism to follow in any way implies censure of the publisher or the authors. This pamphlet represents a sincere desire to serve the ophthalmic practitioner

by making available to him a booklet which will answer many of his patients' questions about cataract. The authors have written what they believe, and the publisher is making this pamphlet available free of charge as a public service and in the spirit of helpfulness.

The pamphlet is simply and clearly written in the form of questions and answers. The section which we wish to discuss is the following:

> Can Glasses Help Cataracts?
>
> Glasses do only one thing—they focus light on the retina . . . Glasses cannot make light rays pass through an opaque or cloudy lens. Glasses have no effect on cataracts and cannot halt progressive cloudiness.

This is hardly a statement with which any sound practitioner would disagree. Glasses do not affect cataracts; they do not halt progressive cloudiness; and they do focus light rays on the retina (under certain conditions). Yet, such a statement will leave many patients with a false and unfortunate belief. To understand this, we must discuss cataract in general.

Kornzweig, Feldstein and Schneider[1] (1957) have presented a splendid study of the visual function of over 1000 older people. That this study is definitive is attested by the fact that in the Optometric Symposium on *Vision of the Aging Patient*,[2] three reliable authors (Weymouth, Ellerbrock and Wick) based parts of their chapters on it.

The patients of this study were 1068 residents in a home for the aged, their ages being over 60 years. The patient's residency was not determined by a visual anomaly but by other factors and, therefore, these data are not too unrepresentative of the older population in general. The following distribution is prepared from these authors' data:

Category	*Number of Eyes*	*Per Cent*
No Cataract	836	39
Incipient Cataract (V. A. to 20/40)	414	19
Immature Cataract (20/50 to 20/80)	670	31
Operable Cataract (20/100 or less)	121	6
Operated	95	5

Before discussing these data, one other aspect of cataract may be cited. Fischer[3] (1947) has stated that the expectancy of cataract is 100 per cent if the patient lives long enough. At about the age of 80, all eyes show some degree of cataract formation.

It is, of course, obvious to optometrists that the critical aspect of cataract is not whether an older patient does or does not have it, but the degree of opacity, its location, and its rate of change. If the optometrist were to neglect these considerations and were to give the pamphlet

in question to every patient with cataract, he would give it to the majority of his older patients.

The striking feature of Kornzweig's distribution is the fact that 50 per cent of older patients have some degree of incipient or immature cataract and an acuity of 20/80 or better, while only 11 per cent have operable or operated cataracts. It is the optometric responsibility to this 50 per cent group which concerns us greatly. They are entitled to more than a pamphlet!

Kaplan[4] (1959) has pointed out to optometrists the value of early referral of patients with cataract. The surgeon will wish to assess the patient's general health to aid in determining when surgery might be feasible. Furthermore, it is well for the patient to be seen by the surgeon at a time when the fundus has not become so obscured as to make its observation impossible.

The optometrist who has a patient in this large group of older persons will wish to have the patient seen by an ophthalmologist. This referral is not for immediate surgery, but merely to enable the surgeon to make observations which will be of value to this patient at a later date. But now that this observation has been made and it has been determined that this patient *may* require surgery at a later date, what should happen?

Whether the patient will ever require surgery will depend upon the many factors already described and particularly upon how rapidly the lens is becoming opaque and the length of time the patient lives. But what happens between times?

It is known that approximately 20/40 vision is required to read a newspaper. It is also true that if a patient with 20/80, for example, is given two times magnification, he can read 20/40 type. Thus, a patient with 20/80 vision cannot read a newspaper with lenses which "focus light" from a 40 cm. object on his retina; he can, however, read such type if he is given 2 times magnification, for example, with an 8.00 D. add and instructions to hold the object at 12.5 cms. from his eyes.

This means that depending upon whether he wears high add lenses for magnification or not, the patient can or cannot read newspapers, magazines, or books. More than 30 per cent of the older population are in this state and may remain in it for many years. Clearly, for a period of years, lenses can do far more than focus light for such people; they can make the difference between reading and not reading for many years and, very possibly, for the patient's remaining years of life.

In the past, all too often, older patients in this group were told

that they had cataract, that it would be some time before surgery was recommended, and that glasses other than a subjective correction for distance and a 2.50 or 3.00 D. add would not help. The patient was then doomed to spend a number of his last years incapable of reading, worrying about eventual blindness—blindness which often never came because death intervened.

The pamphlet which we are considering in no way suggests that between the time that cataract makes reading impossible and the time that surgery becomes advisable, spectacles other than usual ones will enable the patient to read. It in no way suggests that a large segment of the older population has cataract of this type. It does not suggest that these patients may remain in this state for many of their last years on earth. On the contrary, it implies that glasses "do not help." We feel that this statement continues the traditional disservice which has been and is being done to these unfortunate patients.

We would like to offer four general conclusions to this discussion:

(A) With regard to handing the patient printed material in lieu of a frank doctor-patient discussion, we believe that the optometrist is shirking half of his responsibility unless he gives the patient individual advice. Each patient is different; each anomaly is different. Patients respond to different presentations. Kindness and understanding, so badly needed by patients, cannot come in printed forms.

(B) With regard to the specific statement in this pamphlet, we feel that many older patients will be misinformed and will, as a result, be condemned unnecessarily to many years of inability to perform.

(C) With regard to the treatment of older patients with cataract, we believe that the traditional concepts are cruel beyond description in their effect upon a great number of older patients. We believe that every optometrist has a responsibility to his patient with early cataract to refer this patient to an ophthalmologist for diagnosis and prognosis. Similarly, however, we believe that the ophthalmologist has a responsibility to refer such patients to the optometrist for appropriate lenses.

We believe that the optometrist should keep the patient's vision functioning and keep the patient reading and with useful vision for as long as possible. We believe that the patient should be told the true facts about cataract, namely, that every person gets cataract if he lives long enough. Of this group, only a small percentage live long enough to require surgery. It is unthinkable to leave these older people with nothing to which they may look forward except ultimate blindness or surgery (which they usually fear) when actually only a small percentage of them will ever reach such a state.

(D) This entire discussion vividly demonstrates the misery which can be caused to many patients by certain present concepts. An attitude of dealing with individuals by the optometrist, a knowledge of the facts about cataract as it affects our older patients, an attitude of kindliness and understanding of the problems of aging and perhaps, most important, an attitude of mutual respect and cooperation by optometrists and ophthalmologists for the patient's good are all needed. The alternative is patients—millions of them—annually condemned to unhappiness, worry, incapacity, and general misery.

MONROE J. HIRSCH

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INSTRUMENT REVIEW

NEW B&L 3x ILLUMINATED MAGNIFIER

Bausch & Lomb has introduced a new 3x Illuminated Magnifier which promises widespread application in educational, industrial, design and engineering centers as well as in the home, Figure 1.

Outstanding features of the new instrument include full corrected 3x magnification and a wide field of view, making it an excellent

Fig. 1. 3x illuminated magnifier.

inspection aid wherever a quick, accurate examination of small objects is needed. The magnifier rests securely on any flat surface, allowing complete freedom of both hands. Special design of the new model produces even illumination covering the entire area under examination. Toolmakers, quality control personnel, students, graphic artists, home workshop enthusiasts and hobbyists are only a few of the many people who should find the new Illuminated Magnifier ideally suited to their needs.

The 3x magnifier has an attractive gray finish and features lightweight, yet durable construction. Compact dimensions (5"x3"x3¼") allow the new model to utilize a minimum of workbench or table space. Bausch & Lomb offers a choice of battery operated or 115-volt model, both with list price of $14.75. Price does not include batteries. Further information is available by writing to Consumer Products Sales, Bausch & Lomb Incorporated, Rochester 2, New York.

MAGNIFYING AID FOR CONTACT LENS FITTING

Roberts' Ophthalmic Instruments, Inc., Moberly, Missouri, announces the availability of the Brungardt Magnifier, an aid for the fitting of contact lenses, Figure 1.

Fig. 1. Brungardt magnifier.

The Brungardt Magnifier fits the standard Welch Allyn, Bausch & Lomb or American Optical Finoff Transilluminators, which provide the oblique illumination essential to contact lens edge inspection. A system of four precision ground lenses produce an achromatic, distortion free 10x magnification. The magnifier is sold by major optical laboratories. Additional information may be obtained by writing the manufacturer: Roberts' Ophthalmic Instruments, Inc., Moberly, Missouri.

NEW COLORED FUNDUS PHOTOGRAPHY

Color fundus photography, ordinarily achievable only with the aid of a specialized camera costing between $650.00 and $1,200.00 is now available by means of a simple and inexpensive attachment to the normal binocular ophthalmoscope. This new attachment has been developed in Australia.* Color photography of the back of the eye is a most valuable adjunct to both medicine and optometry. It enables minute changes to be observed between consecutive photographs of the same eye, affording early diagnosis of general and specific eye conditions.

The attachment, Figure 1, which was designed by G. Amigo,

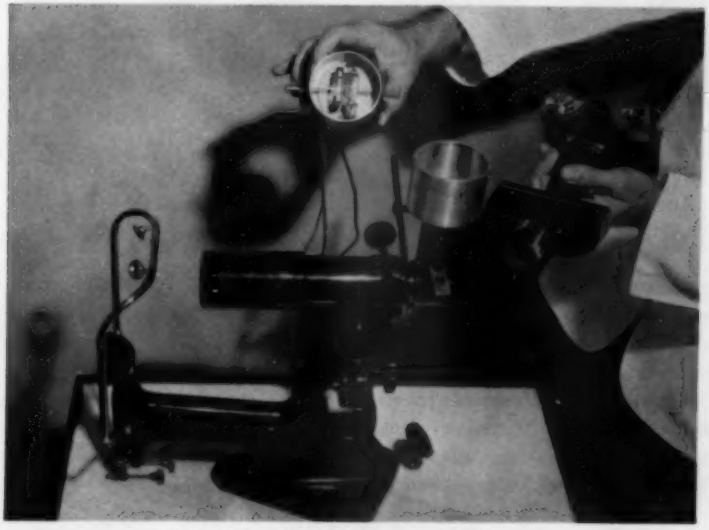

Fig. 1. View of lighting attachment.

*Australian News & Information Bureau. 636 Fifth Ave., New York 20, N. Y.

lecturer in the Department of Optometry of the University of New South Wales, replaces the original light source of the conventional B & L ophthalmoscope with a standard festoon lamp of 15 W. and a xenon-filled discharge tube, half an inch between electrodes and capable of taking 250 joules. This flash tube was specially made by Mr. B. Hutton, of the Photographic Technical Centre Pty., Ltd., Sydney, to Amigo's specifications. A booster pack increases the original output of flashgun to 240 joules.

The binocular eyepiece of the ophthalmoscope is replaced by a monocular one for photography. The camera, Figure 2, may be mounted

Fig. 2. Instrument with camera and lighting attachment in place.

on the eyepiece or on the barrel of the instrument. The cost of alterations to the instrument and the new flash attachment is approximately $60.00.

The Department of Optometry at the University of New South Wales provides professional training for optometrical students and prescribes spectacles and other eye aids to some 2,500 persons a year. These include staff and students at the University, and a number of patients of government and semi-government institutions.

CURRENT COMMENTS

Terry Judith Parkins
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department: such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

A.O.A. ELECTS NEW OFFICERS

The A.O.A. administration headed by newly elected president Dr. Richard C. Schiller, Marshalltown, Iowa, got off to a bad start when NEWSWEEK* reviewed the current pious ophthalmological opposition to contact lenses and then quoted the 1960 A.M.A. resolution that contact lens fitting was a function of physicians. When interviewed by NEWSWEEK, president Schiller's rebuttal was far from complete and lacked conviction. Perhaps he was mouse-trapped into making a quick off-the-cuff statement. That is hardly a good excuse and it is hoped he will do better next time. Other A.O.A. officers elected in Atlanta, June 26-29, are Dr. Don A. Frantz, DeKalb, Illinois, president elect: Dr. Roy M. Swain, Ukiah, California, vice-president: Dr. H. Ward Ewalt, Pittsburgh, secretary-treasurer. Dr. P. N. DeVere, Morgantown, North Carolina, immediate past-president, will serve on the board along with the following trustees, Dr. W. Judd Chapman, Tallahassee, Florida; Dr. Melvin B. Dunbar, Lebanon, New Hampshire; Dr. Joseph E. Rowan, Lyons, Kansas, and Dr. J. Herman Thomas, Forth Worth.

THE INTERNATIONAL OPTICAL LEAGUE

The International Optical League has been in existence for a number of years. It consists of a federation of national optical and optometric organizations working together to improve the well being of optometrists throughout the world.

For the past several years the American Academy of Optometry has been a member of the International Optical League. Membership was accepted by the Academy during the presidency of Dr. Meredith W. Morgan. Mr. Eric Bateman, secretary of the British Chapter of the Academy, has represented the Academy on the governing board of the League and has attended several annual meetings. Mr. George H. Giles, secretary of the British Optical Association, is president of the League. As editor Koch says, "Giles is the anchor man of British optometry and that explains why the League has done so well."

As the League concerns itself to a very great extent with economic

*Issue of August 8, 1960. Pages 48-49.

and legislative wellbeing of optometrists some questions were raised as to why the American Academy of Optometry was affiliated with the League as these main spheres of activity were outside of the general scope of Academy planning, although naturally Academy members are interested in furthering the position of the profession in these areas as well as in education.

It was the concensus of the Executive Council at the time the Academy accepted the invitation to join the League that as an organization we should encourage and support optometrists in every country where they practiced and in joining the League that we help in this useful work. In addition, by joining the League, the Academy focused attention within the U. S. on optometric activities in Europe and elsewhere and in time the hope was expressed that the American Optometric Association would broaden its spheres of interest and that it, too, would develop an international outlook and also become a member organization in the League.

This has now happened and at its recent meeting in Madrid the International Optical League voted to accept the A.O.A. as a member organization. The Academy will continue to belong, but it was agreed in advance that the Academy would defer to the A.O.A. thus permitting the larger organization to select the U. S. delegate to sit on the governing board of the League.

It is hoped by forward looking optometrists both here and abroad that the united support of the League by both the Academy and the A.O.A. will help make the work of the League even more effective in the future. There certainly is a place for this sort of organizational work within the world wide scope of optometric practice, as at present the League is doing a fine job in spreading the gospel of better optometry and optometric practice concepts.

FIFTH NATIONAL CONTACT LENS CONGRESS

A look into the future, where contact lens practitioners will see everyday use of contact lenses thin as paper, will be among previews of "tomorrow's" advancements to be unveiled for delegates of the Fifth National Contact Lens Congress, scheduled to draw record breaking national attendance of more than 3,000.

The widely anticipated annual event will open in New York on October 30-31 at the Biltmore Hotel; Midwest delegates will attend on November 13-14 in Chicago's Sheraton Towers, and the Congress moves westward on November 20-21 to the Jack Tar Hotel in San Francisco.

One of the nationally known authorities previewing tomorrow's

news today is C. Edward Williams, O.D., of Denver, Colorado, recently active in extensive research on the centering of contact lenses. Dr. Williams, who is also well known for his work in subnormal vision, will present a demonstration of new techniques for lens centering, and will discuss use of exceptionally thin contact lenses.

More than 1,000 delegates expected in each of the three Congress cities will see new techniques for fitting children with contact lenses presented by Neal J. Bailey, O.D., of Cleveland, Ohio, former faculty member of Indiana University and a researcher on instrumentation and techniques connected with contact lenses for children. His demonstration will include children of various ages.

Lens thickness factors, long the subject of much research, will be discussed by Joseph Cinefro. A new method for measuring thickness at any point on the lens, recently developed by Cinefro and Ray Rusher, of Chicago, will be presented to the Congress.

Developments in other countries will keynote the Congress. From Melbourne, Australia, Thomas F. Spring, M.D., will discuss aphakia, a subject of major importance to all contact lens circles. Currently one of the most widely discussed problems, treatment of aphakia, has advenced through newer uses of contact lenses following surgery. Fitting contact lenses to aphakics of all age groups will be a paramount point in Dr. Spring's discussion.

Mexico's Jose Tortolero, M.D., who recently completed a year-long study of the effects of contact lenses on corneal tissues, will present his research findings on that subject.

Other speakers of international note include John de Carle, F.S.M.C., of London, England, and Gilbert Cepero, M.D., Havana, Cuba.

THE STORY OF CONTACT LENSES BY SALVATORI

A beautifully produced book on contact lenses has been published by Obrig Laboratories, Inc. Entitled *The Story of Contact Lenses*, the book was written by Philip L. Salvatori, president of Obrig, to answer the need for an authoritative yet nontechnical presentation of this subject.

Mr. Salvatori is the author of standard professional textbooks on contact lenses. He has written the present volume with the lay reader in mind. The book is ideally suited for use in ophthalmologists', optometrists' and opticians' reception rooms. An introductory section, "Why Contact Lenses?", places the subject in perspective within the entire field of eye care. There follow sections which trace the history of the development of contact lenses since the early nineteenth century,

explain how modern contact lenses work, and show through unusual photographs how the lenses are made.

The final section is called "A Word of Caution." Here the author addresses himself to the general public and emphasizes a theme which runs throughout the book—only specialists in the field of eye care are qualified to decide who should use contact lenses and which lenses are best suited for a particular patient! The book's last paragraph states: "No one should buy contact lenses on the strength of an advertisement. No one should assume that another person's good experience with them insures his own success. The only safe way to get contact lenses is through a trusted specialist in eye care."

In addition to fine photographs, the book contains many woodcuts, drawings and other art especially commissioned to illustrate this volume. Inserts of hand-made papers which set off each colorful section add still more visual interest to this unique presentation of the subject. *The Story of Contact Lenses*, 58 pages, bound in hard covers of black linen, is being made available by the publisher at cost. Copies can be ordered for $3.75 from Obrig Laboratories, Inc., Box 791, Sarasota, Florida.

NEWS BRIEFS

Colonel Bernard Korn, U.S.A.F., M.S.C., has been appointed Chief of the Medical Service Corps, United States Air Force Medical Service, by Major General O. K. Niess, U.S.A.F. Surgeon General. Colonel Korn replaced Colonel Leonard P. Zagelow, U.S.A.F., M.S.C., who has been reassigned to the Fifth Air Force in Japan. The Medical Service Corps within the U.S.A.F. Medical Service includes medical administrators, medical supply officers, pharmacists, optometrists, sanitary and industrial hygiene engineers, entomologists, clinical laboratory officers, aviation physiologists, psychologists, psychiatric social workers, and health physicists. . . . The Optometric Center of New York, 11 West 36th St., New York 18, has arranged a series of 17 postgraduate courses to run throughout the Fall and Winter. A booklet reviewing these will be sent on request. . . . Peter V. Conigam, Aberdeen, Washington, is this year's winner of the Titmus Merit Scholarship in pre-optometry, sponsored by the Titmus Optical Company, Petersburg, Virginia. He will attend Pacific University. . . . Dr. Henry N. Peters, Jr., national Secretary of the Southern College of Optometry Alumni Association, would appreciate receiving a card or letter giving the current address of any SCO alumni who has moved within the past two years. Send letters to 1430 Poplar Avenue, Memphis, Tennessee. . . .

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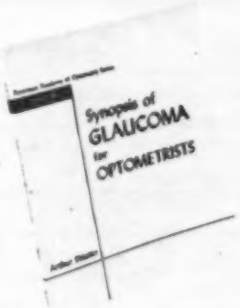
ARTHUR SHLAIFER, Ph.D., Penn. State College of Optometry



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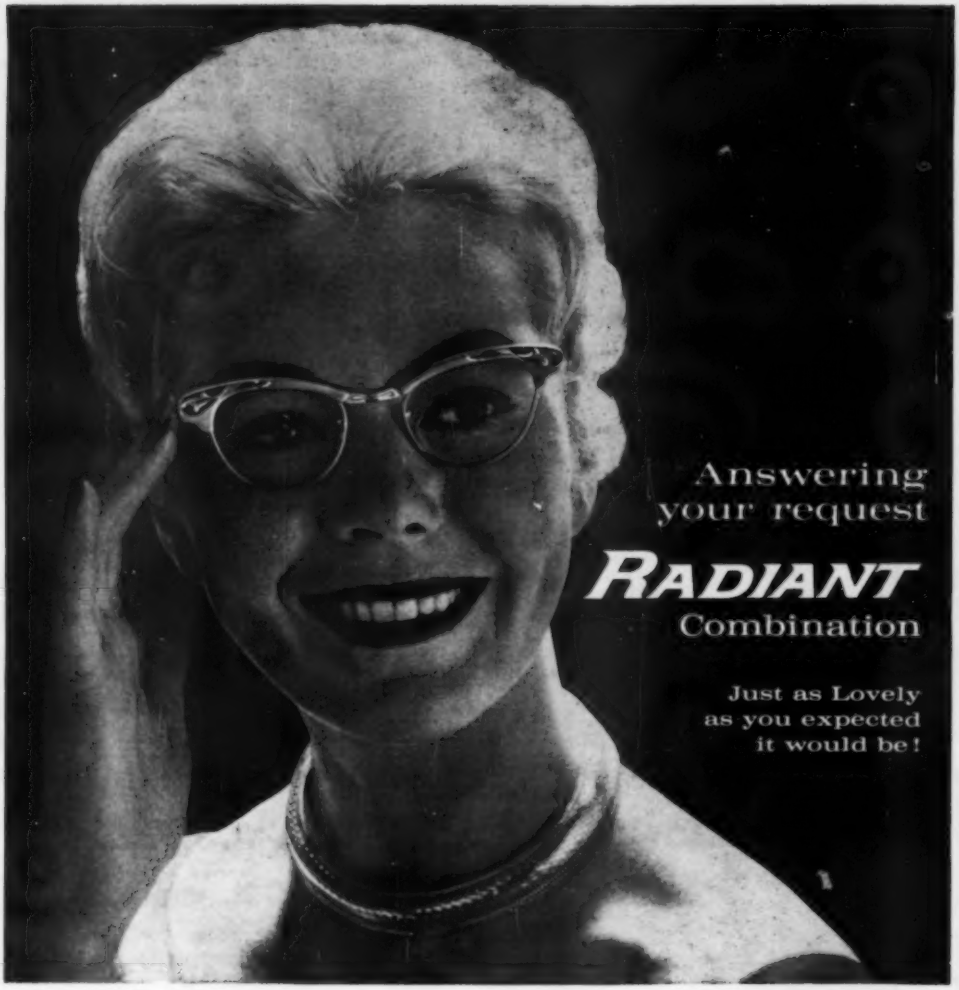

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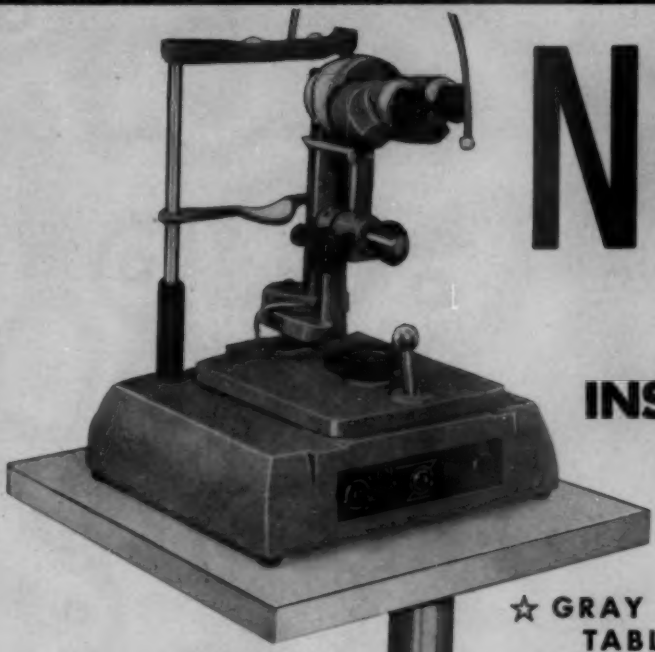

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